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Enzymes As Adjuncts In Therapy†

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THE clinical value of enzymes as adjuncts to treatment of pathologic processes in human patients has been under study for a number of years. Of late, because of possible threat of atomic warfare, with large numbers of human casualties suffering with burns, considerable emphasis is being placed on finding agents that may be used in treating these patients quickly and economically. Even though numerous methods and agents have been tried for the therapy of burns, as yet none have been found to be wholly satisfactory. Many are obsolete.

One of the objectives in the treatment of thermal wounds is to prevent formation of excessive granulation tissue so as to minimize amount of cicatricial tissue or eschar formation. When an excessive amount of scaring is a consequence of healing, skin grafts often are employed to restore normal function and appearance to the region.

Although surgical removal of the eschar usually leaves a clean, healthy, granulating surface that will heal, such procedure would not be feasible in the treatment of mass casualties. Also, investigative studies have revealed that developing within these hard eschars are numerous small islands or "buds" of healthy epithelial tissue which, in themselves, if not disturbed, act as portions of new skin grafts.

Materials now are available for clinical trials for use in the treatment of burns in human patients. These agents applied directly to the eschar cause softening of the hard, leathery, granulating tissue, permitting it to be wiped or stripped away, leaving in its place healthy underlying tissue containing new epithelial tissue "buds". One of these substances, proteinase A, has been tried for debridement in burn therapy.

Proteinase A is an enzyme produced from filtrates of a culture of an aerobic soil saprophyte. Studies indicate that, when applied as a solution in the form of wet pack, proteinase A will liquefy the eschar of deep, second degree and third degree burns in approximately 18 to 24 hours. When the eschar is digested, the underlying tissue is a clean surface suitable either for skin grafting or first intention healing[1].

Enzyme Therapy

In the practice of veterinary medicine the application of various enzymes as adjuncts in the treatment of necrotic and suppurative processes has shown promise. The period of healing of inflammatory conditions is shortened. Further, the use of such agents allows for better penetration of antibiotic or chemotherapeutic agents.

Enzymes are specific, biochemical, organic, catalytic agents produced by living cells. In industry, catalysts are used extensively because of their ability to influence or alter the speed of a reaction without appearing in the final products of the reaction. Although a class of proteins of high molecular weight,

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they are classified and identified by the nature of the substance or substrate upon which they act. The enzyme urease, which converts urea into ammonia, is an example. Enzymes are susceptible to changes in temperature and in pH. Although as a rule enzyme-catalyzed reactions proceed faster at elevated temperatures, the enzyme also becomes deactivated much faster. The optimum pH either for maximum stability or fastest reaction varies among individual enzymes. Lastly, in many cases it appears that the presence of bivalent ions or "metallic activators" are needed both to increase the activity and to maintain greater stability of the enzyme solution. As an example, optimum enzyme activity is obtained when calcium is combined with trypsin or magnesium is conjoined with pancreatic dornase.

Streptodornase and Streptokinase

Streptodornase and streptokinase are produced by certain strains of beta-hemolytic streptococci. For clinical use, these are available in powder form as a vacuum dried, sterilized mixture. Each vial of the mixture contains 100,000 units of streptokinase and 25,000 units of streptodornase.

Streptokinase is considered to be a potent fibrinolytic agent[3]. This mode of action is not known but it is hypothesized that "plasminogen", an inactive component in serum, is activated by the enzyme into the active factor "plasmin"[3]. In the presence of the latter, fibrin undergoes a type of hydrolysis with the formation of several smaller polypeptide fragments.

Thus, streptokinase, may be regarded as an "enzyme activator" which, in plasma, acts on the inactive enzyme plasminogen to produce the active enzyme plasmin.

Streptodornase, streptococcal desoxyribonuclease, is active in catalyzing the breakdown of nucleoprotein, the component responsible for much of the thickness and viscosity in purulent and fibrinous exudate[4]. This enzyme, by causing hydrolytic lysis of the desoxyribonucleoprotein in the exudate, facilitates drainage and allows for more rapid healing in the area of infection. There is liquefaction both of the extracellular nucleoprotein and the degenerating cell nuclei without change or breakdown in the living, intact leukocyte[4].

Archibald and Hodgson[6] have described the clinical use of the combination of streptokinase and streptodornase in small animals. The dose suggested was 15,000 units of streptokinase and 3,750 units of streptodornase in buffered physiologic saline solution administered either alone or in combination with penicillin. For enzymatic debridement purposes, the mixture injected either directly into or around inflammatory processes, was useful in treatment of septic arthritis, wounds, acute mastitis, abscesses, osteomyelitis, and endometritis.

The manufacturer recommends that the combination of streptodornase and streptokinase be administered only for local or topical application in instances where clotted blood and fibrinous or purulent inflammation is present. These enzymes are not to be administered in the presence of active hemorrhage, acute cellulitis without suppuration, or intravenously.

Trypsin

This preparation stimulated considerable interest in the medical profession following the published clinical findings of I. Innerfield and his associates[7] who suggested its use intravenously in human patients because of its fibrinolytic action on intravascular thrombi.

Trypsin is a highly purified, crystalline enzyme isolated from mammalian beef pancreas. The dried, lyophilized form remains stable for long periods, but once placed in solution deteriorates rapidly; approximately 50% of its activity is lost in the first three hours. It is an excellent example of the "proteolytic enzyme" since the agent catalyzes the hydrolysis of proteins, breaking them into smaller fragments, including amino acids.

Experimental studies have shown that intravenous injections of trypsin evoke a divergence of responses in both blood pressure and blood coagulation. When dogs and rabbits were given varying amounts of trypsin intravenously, there was not only a prolongation of the blood coagulation time, but also a simultaneous fall in blood pressure, the latter lasting from approximately six to 16 minutes[8]. This phenomenon may not be evoked or be as dramatic when the enzyme is injected slowly, since "these effects are inhibited by the natural antitryptic properties of the serum"[9]. Slow infusion of large doses of trypsin exhibited an anticoagulant effect.

This complexity of changes or antagonism between coagulation and anticoagulation in the blood has been studied by different investigators[8,9,10,11]. It is probable that these conflicting results are due to differences in the rate of infusion, concentration, and the total dose. It also is assumed that trypsin acts as a catalytic agent in the conversion of profibrinolysin (fibrinokinase)[12] and in the activa-

tion of prothrombin to thrombin (thrombokinase)[13].

Innerfield and his colleagues[14] suggest that the anticoagulant effect is not necessarily one of direct trypsin-fibrin substrate interaction, but probably that of activation of the fibrinolytic system.

L. E. Johnson[15] reported on the enzymatic debridement activity of trypsin in the treatment of various suppurative processes in large animals. Although the dosage and method of application are not recalled, the agent was stated to be useful in the treatment of frontal sinusitis and traumatic pericarditis in cows and suppurative arthritis and fistulous withers in horses.

A recent article by Johnson and Ferguson[16] discusses a number of clinical conditions treated with chymotrypsin; a purified enzyme isolated from the mammalian pancreas having proteolytic activity similar to trypsin. In the cow and horse, chymotrypsin therapy is effective in suppurative pericarditis, sinusitis, fistulous withers, and foot canker. A transit elevation in body temperature in the treated animals is observed following administration of the enzyme into a closed cavity. It is suggested that the hyperthermic effect is due to the absorption of toxic materials or products resulting from protein hydrolysis.

Mills[17] suggests the application of trypsin in the treatment of gangrenous mastitis in dairy cows. Usually in severe cases of this infection, because of the large amount of tissue necrosis, radical surgery is the only method by which adequate drainage is provided so that the life of the animal may be saved. The report recommends daily injections of trypsin in several places in the infected quarter in order to cause liquefaction of the dead tissue and to assist in providing for adequate drainage of the gangrenous tissue.

It has been suggested that the amount of the enzyme needed depends not only upon the size, location, and character of the lesion, but also on the amount of necrotic tissue present. Trypsin may be applied as the powder in the dry form by direct or topical application, deposit of the dry form in gelatin capsules in sinuses or fistulas, or in solution either by irrigation or moist gauze dressing.

Pancreatic Dornase

This enzyme is another of the group that breaks down highly polymerized desoxyribonucleic acid.

Pancreatic dornase or pancreatic desoxyribonuclease is a purified enzyme isolated from beef pancreas by acid extraction followed by fractional precipitation with ammonium sulfate. The final solution is sterilized, frozen, and lyophilized. As mentioned earlier, magnesium is added to the neutral dornase solution to act as stabilizer and activator. The activity of the enzyme is well preserved on storage particularly at low temperatures. The lyophilized preparation dissolves readily in the diluent to yield a clear colorless solution. *In vitro* studies have shown that the different antibiotic agents have no influence upon the activity of pancreatic dornase. The reverse effect is true also. The antibiotics tested were potassium penicillin G, dihydrostreptomycin, bacitracin, polymyxin B sulfate, chlortetracyline, oxytetracycline, chloramphenicol, and tyrothricin[18].

The action of this enzyme differs from that of streptococcal desoxyribonuclease. Pancreatic dornase in purulent material causes only depolymerization "since there is no release of inorganic phosphorus nor does any other readily dialyzable substance occur, and the end products of the reaction appear to be relatively large in size"[19]. Streptococcal desoxyribonuclease on the other hand, not being a single entity but a series of closely related specific enzymes, causes a degradation of desoxyribonucleoprotein similar to that of acid hydrolysis[20].

This less complete degradation of desoxyribonucleoprotein decreases the amount of noxious substances that might be absorbed into the body tissues from local areas of infection. In addition, studies in laboratory animals tend to show that pancreatic dornase does not delay wound closure, whereas comparisons with enzymes of streptococcal origin showed consistent tendency to delay healing[18].

It has been reported that pancreatic dornase exhibits some activity on fibrin and mucus. This is due, probably, to small amounts of trypsin and chymotrypsin[18]. The last mentioned enzymes are both fibrinolytic and mucolytic. The dual enzymatic activity undoubtedly accounts for the effectiveness of pancreatic dornase in liquefying mucopurulent material.

Pyogenic inflammation or "pus" is a viscid, tenacious pathologic substance consisting of pyogenic bacteria, inflammatory exudate, and necrotic tissue with both dead and viable leukocytes. The latter are primarily polymorphonuclear leukocytes. Only after publication of the findings of Sherry and associates[21] was the cause for the stringiness, thickness, and

viscosity of purulent exudates understood. These investigators identified desoxyribonucleoprotein as the important component of purulent and inflammatory exudates. Chemical analysis determined that desoxyribonucleoprotein (nucleic acid in combination with protein) may constitute from 30 to 70% of the total solids present.

Further observations regarding the abundance of the nucleoprotein in purulent exudates was confirmed by the application of dyes specific for it. Pleural exudate stained by the Feulgen method and examined microscopically, revealed leukocytes together with other inflammatory artifacts entangled in a matrix of thick, coarse strands of desoxyribonucleoprotein fibrils. Although there has been identification of the element responsible for the physical characteristics of purulent material, that which accounts for the cytologic changes leading to the production of these fibrils of nucleic acid is not known.

Tillett, *et al.*,[23] after isolating desoxyribonucleoprotein from purulent exudates from human patients demonstrated that the application of either streptococcal concentrate streptokinase and streptodornase, or beef desoxyribonuclease caused rapid lytic changes in the character of the sediment. This catalytic action was due to the presence of the enzyme, desoxyribonuclease.

Armstrong and White[23] working with the enzyme desoxyribonuclease, obtained from beef pancreas, identified also the "fibrin" in purulent exudates. Their technic consisted of using both Feulgen stained preparations and phase-contrast microscopic studies of purulent sputum specimens from human patients. These samples were observed and photomicrographed before and after application of the pancreatic enzyme. From their observations they noted the tendency for the nucleoprotein to undergo polymerization and to take the form of fibrils or rods, and that the viscosity of the purulent exudate changed rapidly under the influence of pancreatic desoxyribonuclease. Upon finding that large intravenous and intratracheal injections of the enzyme into rabbits caused no toxic symptoms, they used aerosolization of the enzyme in treating human patients with chronic chest infections. Clinical benefits were manifested in all the patients treated without the appearance of any toxic or anaphylactic reactions.

Simpson[24] suggests that this web of fibrils in purulent exudate arises as the result of a series of complex changes in eosinophils and neutrophils. In response to certain stimuli, the fibrils are expelled or pour out from refractive granules in the cytoplasm. Once these threads or fibrils reach their objective, the contents of the leukocyte are poured down them and the nucleus becomes filiform; the cell literally becomes a thread. The filiform threads allow for the ability of certain leukocytes to traverse distances, become attached to their objective and gather into groups or adhere to an object.

Toxicity Studies in Dogs

The toxicity of pancreatic dornase is under study in experimental animals. A number of subacute tests with intravenous injection of the enzyme given at various dose levels have been completed in anesthesized dogs. Each dog averaging in total body weight from nine to 14 kg. received in one injection, via the exposed femoral vein, an amount ranging from 500,000 to 4,000,000 units in 5 cc. of sterile diluent. The physiologic effects resulting from these injections were recorded kymographically using a conventional mercury manometer system. In each instance, irrespective of the concentration of the agent infused, a vasodepressor response of short duration was noted. The blood pressure of the animal was normal within two to three minutes following the greatest hypotensive effect. The maximum tolerated dose as a rule readily was predictable. Usually in these instances the animal had been given a total dose of from 4,000,000 to 5,000,000 units and a change had been observed first in respiration. We assume from experience thus far that massive doses of the enzyme kill by causing respiratory failure.

Other than congestion in the lungs, and some petechiae hemorrhages in the heart musculature, no other significant lesions were found in any of the dogs examined grossly at autopsy.

Hematologic studies of the peripheral blood in both rats on chronic toxicity tests and dogs on the previously discussed subacute tests were completed. In rats on chronic toxicity tests, no significant differences were observed between the control animals and those groups of white rats that received 20,000 and 40,000 units per kg. of body weight. Studies of the blood of the dogs on subacute tests showed a transient physiologic increase in the total red blood cells in comparison to a corresponding temporary decrease in the total white blood cells. Serial blood counts following the intravenous administration of pancreatic dornase demonstrated an increase in white blood

cells indicating perhaps that the supplement of new cellular components by phagocytosis may also be contributing to debridement.

Enzyme Nontoxic to Mammary Tissue

Pancreatic dornase has been infused into the udder of normal, lactating cows in order to determine whether abnormal changes would result following the infusion of the enzyme. Upon the completion of the regular milking for the day, single doses of 100,000 and 200,000 units each in 20 cc. of sterile diluent were infused into the right front and right rear quarter, respectively, of one cow; 400,000 and 800,000 units of the enzyme in the same quantity of diluent were infused into the respective quarters of another dairy cow. Each quarter was massaged so as to secure more effective dissemination of the enzyme solution. The treated, lactating quarters were first milked 12 hours later. Physical examination 24 hours after the final injection revealed no changes in any of the mammary glands treated. Microscopic studies of the milk drawn from the treated quarters for 48 hours following pancreatic dornase infusion disclosed a total increase in the leukocyte count.

Use in Suppurative Processes

Pancreatic dornase has been employed as an adjunct in therapy for the treatment of a number of varied types of suppurative processes in veterinary medicine.

In the management of bovine mastitis, depending upon the severity of the inflammation, 50,000 to 100,000 units of the enzyme either by itself or combined with antibiotic or chemotherapeutic agents is infused into the infected quarter. Usually this results not only in prompt liquefaction of the caseous material but also in a more rapid response to recovery.

Drury[86] believes that pancreatic dornase holds promise for use in the treatment of mastitis since the application of the enzyme by digesting "the fibrin and coagulated proteins in the tubules" allows for better penetration of the antibiotic or chemotherapeutic compound to the source of infection,

Abscesses and wounds in cattle, horses, dogs, and cats have shown distinct clinical improvement following the infusion of pancreatic dornase. Concentrations of from 50,000 to 100,000 units administered either by injection, irrigation, or wet pack for one or more applications have been suggested. This regimen, with or without antibiotic agents has brought about liquefaction of the pus and removal of necrotic tissue with complete and prompt healing.

Raker[98] relates a number of case reports in large animals treated successfully with pancreatic dornase. Among these are bovine mastitis, umbilical and joint abscesses, infected wounds and sinus tracts, and traumatic pericarditis. Even though the use of pancreatic dornase resulted in improvement of the disease condition, the author believes that the application of the enzyme in the treatment of traumatic pericarditis and actinomycosis needs further study.

Sinusitis in both equines and bovines has responded to therapy with the combination of pancreatic dornase and antibiotics.

Kral[87] described and introduced a new procedure for the treatment of this purulent condition in horses. This method is based upon the principle that one or more openings slightly larger than a 16 gauge needle, in contrast to the large trephine openings into the sinus ordinarily used for drainage, are utilized for the introduction of the enzyme. With this technic, solutions of the enzyme are injected into the infected sinus through a sterile needle or polyethylene tubing and allowed to remain for 24 hours, when the sinus is flushed with warm saline solution. The procedure is continued daily for one or more treatments until the character and viscosity of the pus changes, at which time local antibiotic therapy is begun.

Summary

This paper is a description of three currently available enzyme preparations that ultimately may be found useful in the treatment of pathologic conditions in veterinary medicine.

One of these, a combination of streptokinase and streptodornase, is obtained from strains of hemolytic streptococci. Streptokinase, by converting inactive plasminogen in the blood into the active factor plasmin, is a potent fibrinolytic agent. Streptodornase, a desoxyribonuclease, acts on the desoxyribonucleoprotein of suppurative processes to bring about liquefaction of purulent material. The toxicity of this mixture depends not only upon the location and the type of lesion treated, but also on the dosage administered. It is recommended that they not be injected intravenously.

Trypsin is a highly purified crystalline enzyme. Like streptokinase, it is primarily a fibrinolytic agent.

Pancreatic dornase is similar in activity to streptodornase. It has the ability to liquefy

the stringy fibrils of nucleoprotein in suppurative processes. Because of its potency and activity, as well as freedom from toxicity, pancreatic dornase may be used to advantage in the management of numerous suppurative pathologic conditions in animals.

These preparations are to be considered only as adjuncts in therapy, but, as such, they offer hope of improvement in the present procedures for dealing with hematomas and local infections. Their usefulness lies in their ability to stimulate the rapid removal of fibrin and caseous material, and to bring into contact the organisms and the antibiotic or chemotherapeutic agents used in the treatment of the infection.

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▼ ▼ ▼

Successful treatment of *Eimeria tenella* coccidiosis infections in poultry with furazolidone (furoxone,® Eaton) by Dr. P. H. Harwood and D. I. Stunz was reported at the 29th annual meeting of the American Society of Parasitologists in Memphis, Tenn., during November, 1954, and recorded in *Jour. Parasit.*, 40:24 (Oct.), 1954.

The nitrofuran, furazolidone, prevents deaths at a level of 0.011% in the feed, if given not later than 48 hours after infection. At 0.0055% of the feed, mortality is reduced about two-thirds, and "development of immunity in treated groups is not retarded." The toxicity of furazolidone is now, with the $l.d._{50}$ for chickens at about 500 mg. per kg. On the other hand, the investigators reported that chickens receiving from 0.0011% to 0.02% furazolidone in the feed show an increased growth rate that is most apparent under conditions of poor sanitation.

▼ ▼ ▼

If the rate of condemnations for 1917 prevailed in 1953 approximately $150,000,000. worth of meat would have been condemned for human food. — *C. D. Van Houweling, D.V.M.*

The Nutritional Concept As The Underlying Cause Of Bovine Ketosis

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IN 1950, Shaw and coworkers advanced the theory that bovine ketosis is the direct result of an adrenal-cortical insufficiency[1,2]. Since then this concept has dominated much of present day thinking about ketosis,[3-7] although some investigators have questioned its adequacy[3-7]. Cortisone and ACTH are regarded by many as being "specific" for spontaneous primary ketosis. Referring to cortisone, Shaw[3] has stated that, "Cows which do not exhibit a good response either do not have spontaneous ketosis or the ketosis is complicated by other abnormalities." Practitioners reporting failures with ACTH or cortisone have been told that they probably are dealing with another disease or with chronic ketosis, fasting ketosis, or secondary ketosis due to such conditions as metritis, mastitis, traumatic reticulitis, et cetera[9,10]. We are told that severe primary ketosis is difficult to diagnose,[11] and that relapses after treatment are "merely a worsening of the condition following a preliminary response"[12]. Such use of an unexplained response to a drug as a diagnostic criterion for ketosis rather than the objective findings of hypoglycemia, ketonemia, normal white blood cell count, and negative findings on physical examination appears unsound not only from the point of view of good clinical practice but also because it shifts from the etiology of the primary metabolic disturbance and from the ultimate goal, prevention.

No serious student of ketosis cares to minimize the role of the pituitary adrenal-cortical axis to the stress of this disease. The fault lies in perspective and in the failure to point out that the stress responsible for the adrenal-cortical insufficiency is faulty nutrition. Sampson,[6] and Dye and McCandess[13] have stated that prevention of ketosis can be aided by seeing to it that animals maintain good appetites and have adequate rations. Many investigators[14-17] have reported significant lowering in the incidence of ketosis in dairy herds by correcting faulty feeding practices (chart 1).

Stress the Trigger Mechanism

Accumulating knowledge indicates that the course of events in postpartum bovine ketonemia may be outlined as follows: The outpouring of a large volume of milk results in a loss of carbohydrate, protein, fat, and minerals. A negative balance or state of nutritional deficiency results. This starvation stimulates the production of ketone acids in excess of the body's ability to oxidize them and ketonemia results. The adrenal cortex reacts to this stressful situation and, by augmenting body catabolism, contributes to the ketosis.

Fig. 1. Six-year-old Jersey cow with early primary postpartum ketosis. Patchy, fat deposition is still visible over tuber ischii. This cow eats sparingly and is losing flesh rapidly. However, milk production holds at 40 lb. per day although her peak approached 50 lb.

That the stress predisposing to ketosis is faulty nutrition is indicated by the findings of Sampson,[6] Roberts,[22] Moore,[23] Vigue,[14] and others.

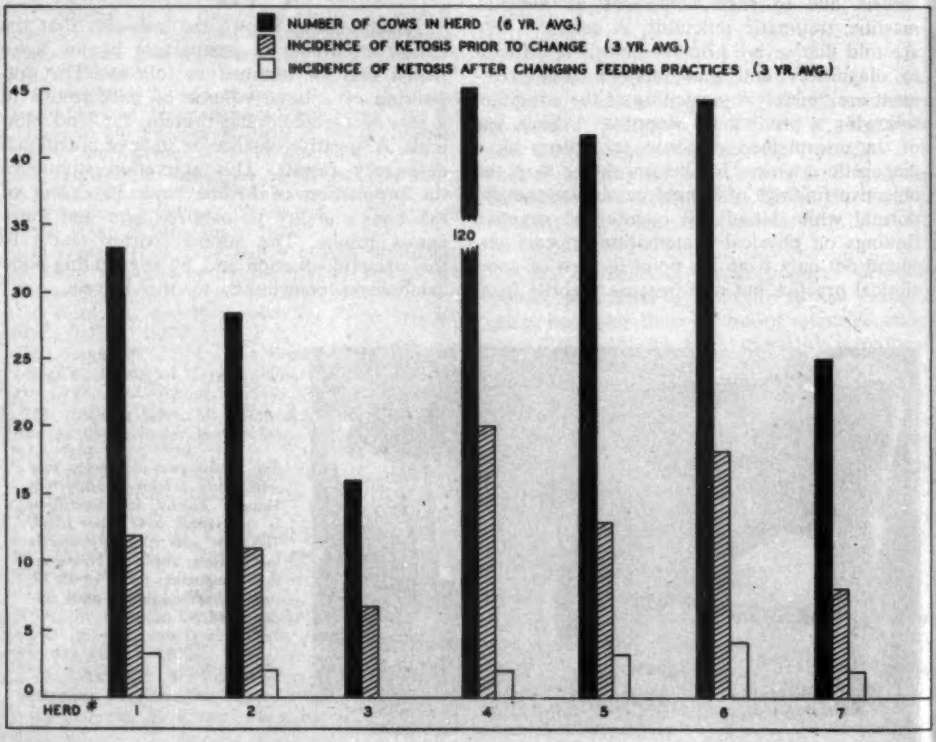
If we examine the general adaptation syndrome as defined by Selye,[19] it is evident that the histological changes in the anterior pituitary and adrenal cortices in ketosis are similar to changes elicited in these organs by a whole group of stressor factors, *i.e.*, trauma, infectious diseases, exposure to cold and heat, et cetera. In this way ketosis is associated with adrenal function. Vigue,[14] in a limited experiment, produced relative adrenal-cortical insufficiency in cows by giving large frequent doses of ACTH and cortisone. As was expected, prolonged dosage with ACTH resulted in exhaustion of the adrenal cortex with hypertrophy and focal necrosis, whereas large doses of cortisone caused atrophy. Relative insufficiency was produced as indicated by the rise in circulating eosinophiles and the four-hour ACTH test. Clinical ketosis did not develop. The same worker[14] failed to find the extensive pathology in the adrenals of cows with spontaneous ketosis reported by Shaw[21]. The pathology in primary ketosis is confined largely to the liver[14,19,23]. Talbot, *et.al.*[21] state that, "So far as is known at present, stress-induced hyperfunction of the adrenal cortices is not productive of pathologic changes. Pathology develops when adrenal secretion is excessive or deficient in relation to physiologic needs."

In man, one test for adrenal cortex function is conducted by fasting the patient and measuring the level of blood ketones[7]. A rise indicates normal function.

Basic Role of Nutrition

The role of nutrition has been sadly neglected or misinterpreted by those who have failed to search for underlying causes and who have accepted the adrenal-cortical concept of disease as the sole consideration in treatment. A glance at the seasonal incidence of ketosis as it occurs in New England (chart 2) dramatically illustrates that occurrence is minimal

CHART I. How the incidence of ketosis can be reduced in New England herds by following the feeding practices recommended by the National Research Council, after Vigue[14].



during pasture months and increases in direct proportion to the length of time that cows are stabled[14,19]. Incidence will be noted to be at a minimum during the summer months when cows are on good feed and milk secretion is heaviest.

In a careful study[14] of how a large group of cows were fed from the day they were dried off until the veterinarian was called to treat them for clinical ketosis, it was shown that in every case these ketotic individuals were "short-changed" nutritionally somewhere during this period. In most instances, this was done unintentionally, the dairyman feeling that he was doing a good job of feeding. This situation reflects a rather general misconception of the nutritional requirements of dairy cows during the critical period of pregnancy and lactation. Christian and Segard[24] observed that, "it is a biological miracle that the cow can shift from a standing start of little or no milk production to full speed ahead with three to ten gallons a day in so short a time after calving." When one considers this in relation to the quality of the average roughage and other feed stuffs from which the cow must derive its nutritional needs, a higher incidence of nutritional deficiency and ketosis in the better producers might be expected. Considering a nutritional deficiency as a primary etiological factor, the cutting down of feed allowances after parturition so that consumption lags behind production, appears to be unsound practice. It is based on the erroneous belief that otherwise we damage the udder or that the cow will peak too rapidly and not hold up her milk production. Christian and Segard[24] have discussed the enormity of a good cow's milk production. Vigue[14] has called the ketotic cow " a milking fool". By completely starving several cows during the period when ketosis commonly occurs (a few weeks after calving), he failed to produce spontaneous ketosis in these animals. They developed a ketonemia and a relative adrenal insufficiency as indicated by the rise in circulating eosinophiles and the response to the four hour ACTH test. They failed to develop hypoglycemia and clinical ketosis was not produced. Significantly however, their milk production dropped rapidly to almost zero. On the other hand, ketotic cows keep right on milking on a relatively high plane, even when the nutritional allowances are reduced abruptly. Practitioners witness this repeatedly. Puntriano[25] in his involved hormonal hypothesis recognized that,

"Undoubtedly, a decrease in milk secretion is a tendency of the body to adjust to an inadequate elaboration of cortical hormones. This would cause, to a certain extent, a relief of the hypoglycemic condition and a disappearance of ketosis. In other words, a cow would recuperate without treatment. If there is no reduction in milk secretion, the symptoms of ketosis would be accentuated and serious complications could develop." This has led Vigue to state that, "genetically the ketotic cow can not readjust the production of her anterior pituitary hormones rapidly enough to cope with the dietary insufficiency or other stressful stimuli by reducing her milk secretion."

Tompkins and Wiehl[26] have said that throughout pregnancy in humans "the highest possible level of nutritional efficiency be maintained since each stress episode initiates, or aggravates, a state of deprivation." They list several specific stress factors to be considered: "(1) Physical stress from actual gain in weight in maternal tissues. (2) Metabolic and physiological changes because of increased physical stress. (3) Metabolic and physiologic changes peculiar to pregnancy. (4) The requirements of the placenta, which is a maternal organ.

Seasonal Distribution of Ketosis — A Five Year Average

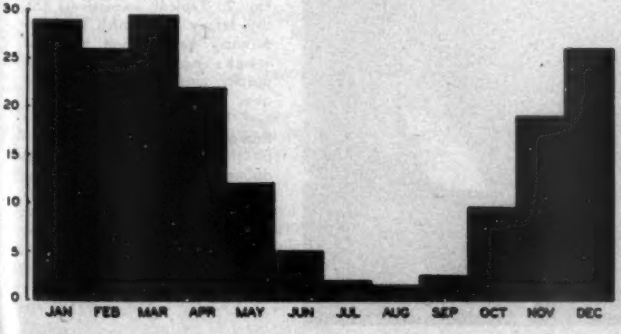


CHART II. Seasonal incidence of clinical ketosis as it occurs in the average New England practice, after Vigue[14].

(5) The requirements of the embryo during the critical formative period as well as fetal needs during the later period of growth and development. (6) The increasing weight of the developing pregnancy."

They further state that: "To meet these needs the intake of high biologic protein is essential, and should represent approximately 75% of the total protein intake. Further, there must be sufficient caloric intake to preclude any possibility of a conditioned deficiency of protein developing, the result of converting dietary protein for energy needs, and to protect tissue integrity."

Too often we have failed to emphasize that one can not separate the roles of protein, carbohydrate, and mineral metabolism in nutrition. It is claimed that a high protein intake either predisposes to ketosis directly or indirectly[22] by increasing milk production. One investigator[14] fed enormous quantities of high protein grain and hay to good cows which previously had been on poor feed. They remained in excellent health, milked heavily, and did not develop ketosis. The writer knows of a cow consuming 58 lb. of a regular commercial milk-cow concentrate daily without deleterious effect. It should be kept in mind that high protein rations also are frequently associated with low caloric allowances and that this latter factor can not be ignored.

It is known that the production of corticotrophic hormone by the pituitary gland is enhanced by a high protein diet[27].

Value of Hormone Therapy

Regarding ACTH and cortisone therapy, it is important to understand that rather than being specific therapeutic agents, they are helpful tools when intelligently employed[9,17,24]. McGirr[23] evaluating ketosis therapy in England stated that, "ACTH preparations of bovine and porcine origin, and cortisone have been used and, in general, have given a level of success in some 50% of cases; a disappointing finding since this result is similar to that obtained with many less expensive forms of acetonemia therapy". These hormones exert a catabolic or antianabolic effect[29] upon tissues that already are overtaxed. They are important in the mechanics of gluconeogenesis which takes place at the expense of tissue protein and fat. In discussing the ketone-decreasing effect of cortisone and ACTH on fasting-induced hyperketonemia, Margen, Kinsell, *et. al.*[19] state that, "The mechanism of this effect appears to be acceleration of the rate of peripheral ketolysis, and/or change of the catabolic pathway of fatty acids".

ACTH and cortisone also assist the homeostatic mechanisms of the body. Perhaps this explains why cortisone is more effective than other compounds influencing carbohydrate metabolism in treating ketosis. Ketogestin is cortisone-mimetic in its gluconeogenetic actions but is devoid of homeostatic properties[14].

Cortisone and ACTH may aid the ketotic cow to adjust her metabolism favorably. However, if we fail to take maximum advantage of the cow's improved status following therapy by doing all that is in our power to adequately nourish her, we are failing to understand the true nature of ketosis, and relapses may be frequent. It is noteworthy that workers[31] using ACTH in northern Ireland found that, "in herds where ketosis is prevalent the animals did not respond so well as the sporadic cases". It would be interesting to compare the nutritional status of these herds.

As is well known, glucose and numerous

Fig. 2. Typical, excessively fat, dry Jersey cow which develops primary ketosis one to three weeks postpartum. Notice patchy, lumpy deposition of fat over hind quarters, shoulders, and back. These animals are thought to be ideally "fitted" by the average New England dairyman. They also differ considerably from animals in herds experiencing high incidence of ketosis observed in other parts of the country.

other theraputic agents[6,9,14,19,20,22,23,32,33] also are employed with success and often can complement hormonal therapy to advantage. A major concern, however, would appear to be the provision of such nutrition as will prevent a starvation syndrome when the cow suffers the excessive, sudden losses incident to high producers in the postpartum period.

Acknowlegements

The author wishes to express his appreciation to the many investigators in the United States and abroad with whom he has maintained a fruitful correspondence, and particularly to Dr. R. F. Vigue, who, through the years, has made freely available all of the fruits of his research and the excellent data in his files, and to Dr. Allan M. Butler of Harvard with whom we have consulted freely whenever the need arose and whose constructive criticism aided in the preparation of this paper.

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Every sick cow should be provided some cobalt salts daily. This may be accomplished by dosing with a few ounces of a cobalt sulfate solution, or the salt may be added to drinking water. Only minute quantities are necessary. —*G. R. Moore, D.V.M.*

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Fall pig crop for 1954 is estimated to be 11% over that of the preceding fall and the 1955 spring crop is expected to increase 4% over 1954.

Isolation Of *Leptospira Pomona* From Three Aborted Bovine Fetuses†

G. D. PODGWAITE,* B.S., M. E. TOURTELLOTTE,* M.S., R. E. JACOBS,* M.S., C. F. HELMBOLDT,* D.V.M., Ph.D., H. L. EASTERBROOKS,* D.V.M., M.S., L. F. WILLIAMS,* M.S., E. L. JUNGHERR,* D.M.V., Vet. Dipl. and W. N. PLASTRIDGE,* Ph.D.

SINCE bovine leptospirosis was first reported in the United States by Jungherr,[1] the importance of the problem to the cattle industry has become increasingly apparent. Reinhard,[2] in reviewing the status of the disease in cattle, noted the presence of bovine leptospirosis in 28 states on the basis of serologic findings.

The association of abortion with leptospiral infection, based on serologic tests, has been reported[3,4,5]. Mathews[6] found leptospira-like structures in silver-stained sections of fetal membranes from a case of abortion. We have been unable to find any report in the literature concerning the actual recovery of the organism from an aborted fetus. The purpose of this communication is to report the isolation of *Leptospira pomona* from three aborted bovine fetuses.

Materials and Methods

The fetuses examined were submitted for the purpose of establishing the cause of abortion. To date, 13 fetuses, one of which was of beef origin, have been cultured for Leptospira.

The outside of each fetus was cleansed by washing with a 3% solution of phenolor®. The skin was reflected from the left side of the abdomen and thorax and the flame of a Bunsen burner applied to the exposed area. The peritoneal and pleural cavities then were opened with a sterile scalpel or scissors. Peritoneal fluid, thoracic fluid, and stomach fluid were removed with sterile pipettes and placed in sterile tubes. Portions of liver and kidney were removed and placed in sterile petri dishes.

Fresh materials were examined under dark field illumination for the presence of Leptospira-like organisms.

Since attempts at isolation from fetuses by direct culturing had been discouraging, owing to contamination of the material being examined, the baby chick inoculation method of Hoag[7] *et al.* was employed. One gram portions of liver and kidney were titrated in 10 ml. of Fletcher's[8] leptospira medium. One-half ml. portions of each were inoculated intraperitoneally into four two-day-old chicks. Undiluted fluids from the stomach, peritoneal, and thoracic cavities were inoculated similarly. Two hours postinoculation, 0.5 ml. of blood was taken by cardiac puncture from two of the four chicks in each series and inoculated into Fletcher's medium. The remaining two chicks in each series were processed similarly at five days postinoculation. All cultures were incubated in the dark at 28 C. All cultures were examined under dark field illumination at two-day intervals and were not discarded as negative until after 30 days incubation.

Simultaneous attempts were made to isolate *Vibrio fetus, Brucella abortus* or other pathogens by already reported methods[9].

Blood sera from the cows that aborted were tested for the presence of antibodies against *L. Pomona, L. canicola* and *L. icterohemorrhagiae* plus *V. fetus* and *Br. abortus*, both at the time of abortion and at variable times afterward.

Results

Case 1. A fetus aborted near term. Dark field examination of fresh materials revealed presumptive evidence of Leptospira-like organisms in the peritoneal and thoracic fluids. Cultures in Fletcher's medium from peritoneal and thoracic fluid both two hours and five days postinoculation passage through chicks were positive on the seventh day. Stomach fluid, liver, and kidney cultures were negative. No other pathogen was isolated. The dam's blood was negative at the time of abor-

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*Department of Animal Diseases, Storrs Agricultural Experiment Station, University of Connecticut, Storrs.

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tion to an agglutination-lysis test for *L. pomona*. A positive titre of 1:100 was present one month after the abnormal parturition. At both times the dam's blood was negative to tube agglutination tests for *V. fetus* and *Br. abortus*.

Case 2. A 3½-month aborted fetus. Dark field examination of fresh materials was negative. Cultures from the peritoneal and thoracic fluids, after chick passage, were positive on the 14th day for Leptospira-like organisms. Stomach fluid, liver, and kidney cultures were negative. No other pathogen was isolated. The dam's blood was negative at the time of abortion to an agglutination-lysis test for *L. pomona*. A positive titre of 1:100 was present when tested four months after abortion. At both times the dam's blood was negative to tube agglutination tests for *V. fetus* and *Br. abortus*.

Case 3. A seven-month aborted fetus. Dark field examination of fresh materials revealed presumptive evidence of Leptospira-like organisms in the peritoneal and thoracic fluids. At the time of this examination suitable chicks were not available, hence the materials were cultured directly in Fletcher's medium. Cultures from the peritoneal and thoracic fluids were positive on the 16th day. Stomach fluid, liver, and kidney cultures were negative. The dam's blood gave a titre of 1:8,000 to an agglutination-lysis test for *L. pomona* at the time of abortion and 1:1,000 on the day the dam was slaughtered (one month later). This cow was simultaneously positive (1:100) to the tube agglutination test for vibriosis at the time of abortion but negative at the time of slaughter. All brucellosis tests were negative. Following autopsy 1 gm. portions of the dam's liver and kidney were triturated in 10 ml. of Fletcher's medium. Cultures from the liver, after passage through chicks, were positive on the 17th day for Leptospira-like organisms. We were unable to isolate *V. fetus* from the fetus or the reproductive tract of the slaughtered animal.

The Leptospira cultures obtained from the three fetuses and one cow were identified as *L. pomona* by agglutination-lysis tests made with hyperimmune serums against known cultures of *L. pomona, L. canicola* and *L. icterohemorrhagiae* which were obtained from the Army Medical Service Graduate School, Walter Reed Army Medical Center, Washington 12, D. C. All of the four cultures gave titres of 1:10,000 with the *L. pomona* antiserum and no agglutination in dilutions, ranging from 1:10 to 1:10,000, with the other two types antiserums.

Discussion

The isolation of *L. pomona* from three aborted bovine fetuses plus the finding of positive blood serum titres in their dams, together with negative cultural and serologic tests for vibriosis and brucellosis, establishes leptospirosis as a cause of bovine abortion.

Fetal pathology and herd reproduction data, to be presented at a later date, suggests that septicemia of the dam or fetus itself is the primary cause of abortion.

Summary

1. *L. pomona* was isolated from three aborted bovine fetuses and one of their dams thereby demonstrating that this organism is a specific etiologic agent in bovine abortion.

2. The passage of suspect material through two-day-old chicks appeared to be a valuable aid in the isolation of *L. pomona*.

3. *L. pomona* was isolated from the peritoneal and thoracic fluids, but not from the stomach fluid, liver, and kidneys of aborted fetuses.

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Technics for freezer storage of bull semen are being investigated by a large number of experiment stations in the United States. With these studies progress toward sex control is reported.

Teat Surgery

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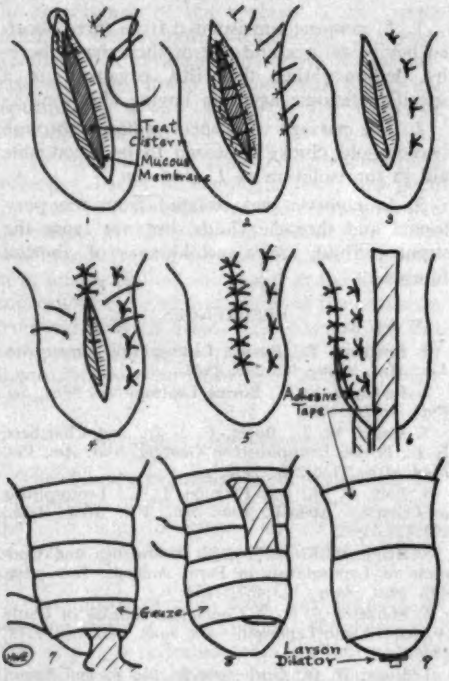
Claremont, New Hampshire

One of the most difficult problems facing dairy practitioners is that of deep lacerations of the teat into the teat cistern. Prognosis always is guarded because of the possibilities of mastitis and fistula in lactating cows. The method illustrated here is applicable in a variety of deep wounds, but for the sake of clarity a simple longitudinal wound is used. Various methods have been tried with varying degrees of success. The method outlined has been most satisfying in our hands.



The period between injury and surgery influences final results. Recoveries are favorable in direct proportion to the delay in surgical treatment. Restraint is always a problem, so whenever possible, we utilize a large-animal operating table to assure clean, rapid, profcssional repair. Asepsis is an ideal to keep in mind, but is difficult, if not impossible, under barnyard conditions. Therefore, the idea of a closure without burying suture material is appealing.

After the cow has been restrained properly, any hair in the vicinity of the wound is clipped away. The area then is cleansed and disinfected. Procaine 2% is used in a ring block to produce anesthesia. Forceps, scalpel, scissors, needle-holder, small curved cutting-edge needle and #1 medium chromic catgut are used in closing the wound. The edges are trimmed to enhance proper apposition. The needle is placed about 1 in. from the wound edge and allowed to appear just above the mucous membrane which is readily distinguished by its definite color. It is introduced just above the membrane on the opposite side and a mattress-type suture is placed. It is reintroduced on the side of origin, and the needle reappears beside the point of origin, as illustrated. After sutures have been placed, they are pulled taught and tied. The mucosal lining is, therefore, apposed accurately. A simple, interrupted stitch is used for the second line. After closure has been completed, the problem of keeping the area bandaged is tackled. Ether is applied to the adhesive strips, and after thorough drying, they are placed on the teat as illustrated. Some wounds allow only one strip of adhesive to be laid. Tyrotrace® and a sterile gauze bandage are placed over the wound, and the teat is wrapped with gauze. Then the strips of adhesive tape are folded over the gauze to anchor it. More tape is placed to give added protection from contamination. In all cases, a tube of mastitis ointment is used after closure. A Larson dilator (flexible teat tube) is placed in the teat of the lactating cow and is allowed to remain open to permit constant drainage so that pressure will not be built up within the teat cistern. We use a dilator in spite of the risk of mastitis, with good results. The bandage is allowed to remain at least ten days, after which sutures are removed. The dilator is removed and the gland is retreated with mastitis ointment.

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®Sharp & Dohme, Philadelphia, Pa.

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A new vaccine for the prevention of losses caused by enterotoxemia, or overeating disease, in sheep is now available. The new vaccine, trade named fringol,® is an aluminum hydroxide adsorbed *Clostridium perfringens* Type D bacterin. Fringol is the first vaccine of this type to be aluminum hydroxide adsorbed for enhancement of immunity by slowing release of the antigenic agent, thus giving the effect of repeated stimulation to immunity. Fringol is manufactured at the Berkeley, California plant of Cutter Laboratories.

Evaluation Of A Leptospira Bacterin Prepared In Culture Medium

ALBERT L. BROWN,* Ph.D., JOHN H. JENSEN,* B.S., ALAN A. CREAMER,* V.M.D., and SAMUEL F. SCHEIDY,* V.M.D.

LEPTOSPIROSIS in cattle has appeared as a new disease of serious importance to the livestock and dairy industries of the United States only within the past five years[1,2]. Because its effects are often severe, there is urgent need for its control. Fortunately, from the standpoint of controlling the disease in infected herds, we believe that vaccination will prove highly effective for two reasons. First, only one species of Leptospira, *Leptospira pomona,* has been identified as the etiological agent on the basis of both serological studies and isolation of the organism. Secondly, it has been shown that serum agglutination-lysis antibody titers need not be high to protect animals completely[3]. Quarantine and other control measures eventually will have to be instituted to prevent the spread of disease from herd to herd.

A bacterin for the specific purpose of protecting cattle against infection by *L. pomona* was developed first by York and Baker[4] by growing the T262 strain in embryonated eggs. In attempting to produce this bacterin in eggs, we became interested in determining whether a good immunizing agent could be produced by growing this same strain in modified Stuart's medium. Attempts at producing such a bacterin were successful and the production and testing of this bacterin is described in a previous paper[5]. Further tests to determine its suitability for the immunization of cattle are described in this report.

Methods

Preparation of Bacterins. The preparation of the bacterin used in these studies has been described in detail previously[5].

Potency Test for Bacterins in Guinea Pigs. For purposes of comparing different lots of bacterin, a guinea pig test was used in which a group of these laboratory animals were inoculated with dilutions of bacterin followed by challenge with virulent Leptospira. Guinea pigs received 1 ml. of bacterin diluted in sterile, physiological saline in the foot pad of the right hind foot. At the same time, a suitable number of control animals were set aside. All guinea pigs were kept in an air conditioned room and temperatures were taken and recorded twice a week during the immunization period. About 14 days after vaccination test animals and controls were inoculated with a virulent strain of *L. pomona,* known as the MLS strain, obtained from Cornell University†. Following challenge, temperatures were taken daily. Any temperature over 104 F. was considered to be a specific response to challenge infection. The febrile response of partially immunized animals was not as high, nor did it last as long, as in the normal control animals. Unvaccinated guinea pigs have responded uniformly with the prolonged temperatures that characterize the infection.

Method of Determining Antibody Titer of Serum. A microscopic agglutination-lysis test was used to detect antibodies. Five-fold dilutions of serum in physiological saline, with a final volume of 0.4 ml., were mixed with an equal volume of an active culture of *L. pomona* strain T262 grown for about six days in modified Stuart's medium. The final dilutions of serum were from 1:10 to 1:31,250. Tubes containing the mixture were incubated in a water bath at 30 C. for three hours. Tests were read by examining 0.04 ml. under a standard sized cover slip with a darkfield microscope using 150X magnification. The readings were recorded as —, ±, +, and ++ using standard pictures as a reference[5]. Both + and ++ readings were recorded as a positive test.

Immunization and Challenge of Cattle. All cattle used in these experiments were dairy type calves purchased locally in Pennsylvania. The calves were brought into a barn and held in isolation for three weeks. If samples of their serum taken when they first arrived

*Research Laboratories, Sharp and Dohme, Division of Merck & Co., Inc., West Point, Pennsylvania.

†Kindly provided by Dr. James A. Baker to whom we are indebted for both the MLS and T262 strain.

and at the end of the holding period were negative for agglutination-lysis antibodies against *L. pomona* at a 1:10 dilution, they were considered suitable for experiments.

Calves were vaccinated by injecting them subcutaneously in the neck with 5 ml. of a bacterin prepared from a culture containing 530,000,000 organisms per ml. Following vaccination, serum samples were obtained weekly and were tested for antibodies.

The calves were challenged, with two exceptions, by inoculating them subcutaneously in the neck with 2 ml. of defibrinated guinea pig blood containing virulent *L. pomona* organisms of the MLS strain. Following challenge, temperatures and blood samples were taken daily. In some cases attempts were made to isolate Leptospira from the blood either by the inoculation of guinea pigs or by growth in culture medium. All blood samples were tested for agglutination-lysis antibodies. The first 11 calves revealed completely negative findings on autopsy.

Results

Immunization and Challenge Studies in Cattle. Before beginning studies on the immunization of cattle, it was necessary to determine whether or not the MLS strain of *L. pomona* was sufficiently virulent to provide an adequate challenge. This strain had been passed continuously in guinea pigs since it was first isolated in November, 1951. Since this organism was passed in our laboratory every three to five days, it obviously had been through a large number of passages and it was thought that its virulence for cattle might have been altered during the course of these passages.

To determine this point, one calf was inoculated subcutaneously with 2 ml. of freshly collected, defibrinated blood pooled from 17 guinea pigs showing typical signs of leptospirosis. Following inoculation, body temperatures and observations were recorded daily. In addition, blood samples were obtained daily and tested for agglutination-lysis antibodies and for the presence of Leptospira. In this experiment, tests were made by inoculating .05 ml. of fresh blood into each of two capped bottles containing 20 ml. of modified Stuart's medium and allowing them to incubate at room temperature for 14 days. On the second day of fever, the blood sample was used also to inoculate three guinea pigs which subsequently showed typical signs of infection. Blood from these three guinea pigs was used to start a new series of passages of MLS and it is this series which has beeen used for all subsequent challenges. Fourteen days following inoculation, this calf was sacrificed and autopsied at the University of Pennsylvania School of Veterinary Medicine*.

Since the findings on this animal were characteristic of the reactions obtained in other studies with this strain of *L. pomona,* they are presented in detail in table I. The cough along with the nasal discharge and general body weakness were the two most characteristic clinical observations. It is interesting that Leptospira were recovered in duplicate cultures

TABLE I. Observations on a Normal Calf Inoculated with L. pomona Strain MLS

Date of Observation	High Temp. Record	Titer of Serum*	Isolation of Leptospira†	Comments
Mar. 26	101.8	—1:10	N.T.	Inoculated with 2 ml. blood containing virulent Leptospira.
27	101.4	N.T.	N.T.	
28	101.0	N.T.	N.T.	
29	101.7	N.T.	+	
30	102.7	N.T.	+	
31	104.0	—1:10	+	Dyspnea, rapid pulse.
Apr. 1	106.6	—1:10	+	Weakness, anorexia, loose stool, rapid pulse and repsiration. Isolation of Leptospira in guinea pigs.
2	106.8	—1:10	+	Cough, depression, enlarged lymph gland, rapid pulse and respiration.
3	105.5	—1:10	+	Cough, dysuria, nasal discharge, rapid pulse and respiration.
4	105.5	+1:10	—	Dry stool, straining, pulse normal, rapid respiration.
5	103.0	N.T.	—	Stronger
6	101.7	+1:1250	—	
7	101.3	+1:6250	—	
8	101.7	+1:6250	—	
9	101.8	+1:6250	—	Autopsied

*In this and subsequent tables, — indicates an agglutination-lysis titer of less than 1:10, + indicates a positive agglutination-lysis titer followed by the highest dilutions of serum showing this reaction, N.T. indicates sample was not tested.

†+indicates isolation and — indicates failure to isolate Leptospira in culture medium.

*We wish to thank Dr. E. L. Stubbs and associates of the Department of Pathology, School of Veterinary Medicine, University of Pennsylvania for assisting with this autopsy.

from the blood for two days before there was any febrile response. Organisms were then recovered until the first day that antibodies appeared. As soon as antibodies appeared, body temperatures dropped and all symptoms of illness disappeared. In contrast to many diseases, the antibody titer increased rapidly; in some cases from — to +1:1250 within 24 hours.

Upon autopsy, no significant lesions were found with the exception of an enlarged lymph gland near the site of inoculation. No Leptospira were found in either the urine sample or in cultures from the kidneys obtained at the time of autopsy. No Leptospira were identified in strained sections of the kidneys or any other tissue that was examined. It was concluded, therefore, that this strain does not localize in the kidneys and that animals infected with it would not shed organisms in their urine. This finding, while unexpected, was useful from the standpoint of handling subsequent animals in the same area.

Since it was felt that a sufficiently virulent strain of Leptospira was being used, immunization experiments were begun. Fifteen dairy-type calves, weighing approximately 500 lb. each, were obtained locally. After determining that these animals were normal for purposes of the experiment, ten were inoculated subcutaneously with 5 ml. of bacterin in the left side of the neck. Five were held for normal controls.

Three weeks postvaccination, five of the immunized calves along with the five unvaccinated control animals were challenged with the MLS strain, 12 guinea pig passages removed from its reisolation from the first experimental calf. (The other five vaccinated calves were held to be challenged at the end of six months.) Following challenge, the same experimental procedure that was employed with the first calf was carried out and the results of this experiment are presented in table II.

Three of the five control calves had elevated temperatures along with other indications of infection as compared to a complete lack of such signs in the immunized group. All control calves had a strong serological response, probably the best indication of active infection. In contrast, none of the immunized calves had an appreciable change in titer following challenge. Unfortunately, due to the technical difficulties involved in taking sterile blood samples, Leptospira was not isolated from any animal. On autopsy, no significant lesions, gross or microscopic, were found in any of the ten animals.

TABLE II. Results of Challenge of Experimental Calves Three Weeks Following Vaccination

Group	Calf no.	Titer of Serum Samples: Pre-immun.	Post-vac. 1 wk.	Post-vac. 3 wks.	Post Challenge	Fever or Other Indication of Infection
Immunized	6080	—1:10	+1:10	+1:10	+1:50	—
	6081	—1:10	+1:50	+1:50	+1:50	—
	6083	—1:10	+1:50	+1:250	+1:250	—
	6088	—1:10	+1:50	+1:10	+1:50	—
	6089	—1:10	+1:50	+1:50	+1:50	—
Control	6086	—1:10			+1:250	+
	6090	—1:10			+1:6250	+
	6092	—1:10			+1:6250	—
	6094	—1:10			+1:6250	+
	6095	—1:10			+1:6250	—

From this experiment it was concluded that the most reliable indication of infection by *L. pomona* is rise in antibody titer. The degree of this response does not appear to be indicative of the seriousness of the infection.

Challenge of Cattle Six Months after Vaccination. The second group of five vaccinated calves was held for six months before being challenged. It was decided to try a different method of inoculation on two normal calves with the purpose in mind of developing a more severe challenge for these animals than the procedure used in the study just reported.

Two normal calves were selected and at the end of the holding period were inoculated intraperitoneally with 5 ml. of guinea pig blood from passage number 45. Body temperatures and blood samples were taken daily but no attempts were made to isolate infective organisms. One of the two calves developed elevated temperature with corresponding symptoms of leptospirosis and this, along with a sharp rise in antibody titer at the time the temperature dropped, indicated that it had been given a good challenge. The other calf had neither a fever nor other signs of leptospiral infection but exhibited as great a serological response as the first. This result was taken as further evidence that serological response is the most reliable indication of infection.

Since changing the method of inoculation did not increase severity of the experimental disease, it was decided to challenge the five vaccinated animals along with five normal controls in the same manner that was used on the first group. The ten cattle were inoculated with blood from guinea pig passage

number 48. Body temperatures and blood samples for serological studies were taken daily. A larger sample of blood was obtained on the eighth day following challenge in an attempt to isolate Leptospira by guinea pig inoculation. To do this, 1 ml. of blood from each calf was inoculated intraperitoneally into each of two guinea pigs for the control group and into each of three for the vaccinated group. Body temperatures of these guinea pigs were taken daily. Any guinea pig showing a temperature over 104 F. was sacrificed, examined for lesions, and a smear of its peritoneal fluid examined for Leptospira under the darkfield microscope. The final determination of leptospiremia in the cattle was based on this microscopic observation. The data from this experiment are presented in table III.

The results of the six months challenge are as clear cut as those of the three week challenge. In the control group, three animals exhibited typical response with high temperature reaction, definite symptoms of leptospiral infection, and a leptospiremia during the febrile period. Two animals, numbers 6063 and 6064, showed a febrile response and symptoms of leptospiral infection which correlated with a low rise in antibody titer. Leptospira were not isolated from their blood since antibodies were present on the day selected for this part of the experiment. It was thought that the lower antibody response in these two animals indicated that they may have had undetected antibodies at the time of challenge.

In the vaccinated group, none of the animals showed any indication of illness. While calf number 6093 did show a slight rise in antibody titer, this animal had not had a positive agglutination-lysis antibody reaction at a 1:10 dilution of serum for four months prior to challenge. Antibody response in this calf was the same as that shown by the two control animals discussed above and lends support to the idea that those animals may have been partially immune. Calf number 6082 which had not had any antibody titer for a period of two months did not develop a titer following challenge, which is again further evidence that high antibody titers are not needed for complete protection.

Stability of the Bacterin

From a practical standpoint, the stability of a vaccine with regard to both its potency and its physical properties when exposed to heat, places a definite limitation on its value. A vaccine with poor stability usually requires special transportation and storage precautions and, as a consequence, increases possibility of inadvertent use of a low potency agent. Demonstration of good stability characterisitics of the bacterin is of considerable importance in analyzing its useful attributes.

Because lyophilization often increases the stability of an antigen, it seemed important to test the relative stability of this bacterin in both the dried and liquid states. For this purpose, it was decided to use an accelerated aging test in conjunction with the guinea pig potency test in order to determine the antigenicity of the preparation both before and after aging. The first series of potency tests was made on the fresh materials prepared from a lot of bacterin containing 117,500,000 Leptospira per ml. Samples were then aged by incubating them at 37 C. for two weeks and for four weeks; these were then retested immediately following the aging period.

From the data presented in table IV it is apparent that the leptospiral antigen, whether lyophilized or liquid, will withstand at least four weeks aging at 37 C. Since the liquid bac-

TABLE III. Results of Challenge of Experimental Calves Six Months Following Vaccination

Group	Calf No.	Titer of Serum Sample: Pre-Immun.	Max.*	Post-vac. 6 mo.	Post-chall.	Fever or Other Ind. of Inf.	Isolation of Leptospira†
Immunized	6082	—1:10	+1:10	—1:10	—1:10	—	—
	6085	—1:10	+1:50	+1:50	+1:10	—	—
	6091	—1:10	+1:50	+1:10	+1:10	—	—
	6093	—1:10	+1:50	—1:10	+1:50	—	—
	6096	—1:10	+1:50	+1:10	+1:10	—	—
Control	6063	—1:10			+1:250	+	—
	6064	—1:10			+1:50	+	—
	6066	—1:10			+1:31,250	+	+
	6129	—1:10			+1:6250	+	+
	F1955	—1:10			+1:6250	+	+

*Highest titer obtained from any of the weekly serum samples.

†Isolation by guinea pig inoculation.

terin maintained its clear and excellent appearance during this aging period, there appears to be little purpose in lyophilization of this product.

TABLE IV. The Heat Stability of the Leptospira Bacterin Tested in Guinea Pigs

	Dilutions of Vaccine				
	1/4	1/8	1/16	1/32	Controls
No Aging					
Lyophilized	0/5*	0/5	2/5	1/5	13/13
Liquid	0/5	1/5	1/5	4/5	
2 Weeks Aging 37C.					
Lyophilized	1/5	0/5	4/5	2/5	12/12
Liquid	1/5	1/5	3/5	4/5	
4 Weeks Aging 37C.					
Lyophilized	1/5	2/5	2/5	4/5	10/10
Liquid	0/5	1/5	2/5	2/5	

*None out of 5 guinea pigs on test showed elevations of temperature characteristic of leptospiral infection.

Discussion

The relationship between agglutination-lysis antibody titers and immunity to leptospirosis has not been determined completely for cattle. It is obvious from the data presented, however, that high levels such as are developed following the natural infection are not necessary for complete protection. In the studies reported here, titers of 1:250 or less have protected fully against the experimental disease as produced by the challenge employed in the first study. The best example of protection afforded by a low degree of immunity is found in the case of the calf which had not had a demonstrable antibody titer for a period of four months but which still had a sufficient residual antibody for protection. It is not unlikely that those animals with low titers at six months might well have remained immune for a period of one year or longer.

A similar situation has been reported[4] for guinea pigs using the same bacterin and the same virulent strain for challenge. Many guinea pigs do not develop detectable antibodies when inoculated with diluted bacterin; however, they are found to be immune to infection when challenged. Furthermore, challenge would seem to be considerably more severe in guinea pigs than in cattle since they customarily have high temperatures for three to five days, with losses in body weight up to 25%.

It is interesting that only two of 13 normal calves did not show the high antibody response characteristic of the infection produced by challenge. Since the serological response in these two animals was so similar to that of the one immunized calf that did not have demonstrable antibodies for four months, it was concluded that these two animals must have had some residual antibodies. It is unlikely that they could have had a natural infection with the corresponding strong serological response and then have lost this within such a short period of time. In the course of testing the serum of young stock from several herds, we have found many calves with low positive titers such as 1:10 or 1:50. It is entirely possible that these received some antibody from their mothers and this coupled with slight exposures has produced low titers.

Summary

Tests in cattle reveal that a single dose of 5 ml. of culture medium bacterin injected subcutaneously elicits sufficient serum antibodies to give an initial positive agglutination-lysis test at serum dilutions of 1:10 to 1:250, titers sufficiently high to indicate good protection. Although the maximal antibody titer is not maintained for six months, there is still sufficient antibody to provide protection from the experimentally-induced disease at the end of this period. A study of the serological pattern in experimental animals over a six-month period encourages the belief that protection may last for as long as one year.

Tests on the stability of this culture medium bacterin show that it is completely stable when exposed to a temperature of 37 C. for four weeks.

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▼ ▼ ▼

Though listeriosis in sheep is referred to commonly as circling disease, not all affected animals walk in a circle. Primary symptoms are drooping ears, ptosis, salivation and nasal discharge. In acute cases, prostration progresses rapidly.—*Frank Thorp, Jr., D.V.M.*

▼ ▼ ▼

One hundred laying hens are equal in value to a good dairy cow.

Preliminary Mycotoxic Studies on Hemorrhagic Disease in Poultry

JOSEPH FORGACS[1], Ph.D. and WALTER T. CARLL[2], D.V.M., Major V. C. U. S. Army

Although chemical, viral, and bacterial agents have been studied as possible causes of hemorrhagic disease in poultry, the role of mycotoxicoses has not been investigated. Samples of feed obtained from various areas where outbreaks of poultry hemorrhagic disease occurred were found to be contaminated with fungi. Groups of day-old White Rock chicks, ten per group, fed scratch grain on which selected strains of Aspergilli, Penicillia, and an Alternaria species isolated from feed samples had been cultured, subsequently exhibited symptoms comparable to those observed in field cases of acute hemorrhagic poultry disease. These included gross subcutaneous and intramuscular hemorrhages, hemorrhages and congestion in the lungs, heart, gastrointestinal tract, and hemorrhages and icterus in the liver. Feed on which the species of Alternaria, had been cultured caused depression, anorexia, fetid diarrhea, and subsequent death when fed to 20 six-week-old chicks. Gross autopsy findings included emaciation, hemorrhages and congestion in the skin, breast muscle, proventriculus, intestines, cecum, lungs, liver, and kidneys; congestion, hemorrhages, and erosion in the gizzard, and paleing of the bone marrow. In addition, on histopathological examination, necrosis, vacuolation, and fatty infiltration were observed in the liver, necrosis in the tubules and round cell infiltration in the kidneys, hyalinization in the spleen, and diminution in formation of blood elements in the bone marrow. Feed obtained from an area in which hemorrhagic disease was not prevalent was contaminated only slightly and did not contain apparent toxic fungi. Chicks fed such feed remained normal.

[1]Viral and Rickettsial Research Section, Research Division, American Cyanamid Company, Lederle Laboratories, Pearl River, N. Y.

[2]Atomic Energy Commission, Agricultural Research Program, Oak Ridge, Tennessee.

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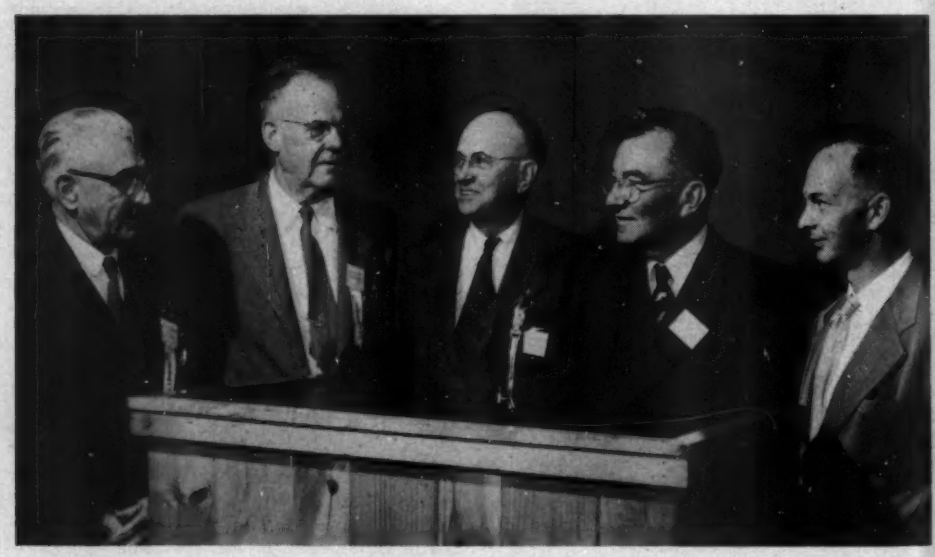
The mere fact that one injects a vaccine or other biological agent into the tissue of an animal does not accomplish immunization. The animal itself builds protection stimulated by the antigenic agent employed.



The Southern Veterinary Medical Association officers for 1955 were named at the close of the 37th annual meeting held at the City Auditorium, Asheville, N. C., October 18-20, 1954. L. to r.: Dr. A. A. Husman, Raleigh, N. C., secretary; Dr. M. R. Balckstock, Spartanburg, S. C., treasurer; Dr. C. C. Van Gremp, Decatur, Ga., 2nd vice president; Dr. E. H. Durr, Jackson, Miss., 1st vice president; and Dr. C. W. Young, Mocksville, N. C., president.

The meeting of this Association for 1955 is scheduled as a combination regional and state meeting with the Florida Veterinary Medical Association at Jacksonville, Fla., October 16-19.

Treatment Of Nymphomania In Cattle

W. B. GRIGOR, D.V.M., Hartville, Ohio

NYMPHOMANIA in cattle due to cystic ovaries has long been a problem to dairymen. High-producing dairy cattle, and a few beef cattle develop multiple follicular cysts in one or both ovaries. These seldom exhibit a normal estrual cycle or conceive until the condition is corrected. Left untreated, cysts becomes chronic and the cow becomes bullish or nymphomaniac. It should be remembered, however, that infertility is merely a symptom of disease and may result from one or more specific diseases of the genital tract, environmental conditions, hereditary factors, or functional disorders. This multiplicity of causes makes diagnosis difficult. Little can be accomplished in a single visit and such a program only leads to a dissatisfied client and a discouraged veterinarian[1].

Accurate diagnosis of the cause of infertility is difficult. At the present time, it is impossible to diagnose functional sterility in cattle due to absent or delayed ovulation, or to factors involving the implantation of the fertilized ovum in the uterus. It is possible, however, to diagnose and treat functional sterility due to failure of estrum and an abnormal estrual cycle caused by cystic ovaries.

Antuitrin-S,® a standardized, highly purified preparation of chorionic gonadotropin (anterior pituitary-like sex hormone) derived from pregnancy urine, has been reported to be of value in the correction of this condition[2-6].

From the many cases in which chorionic gonadotropin has been used successfully, only a few can be cited here.

Deubler[4] was among the first to report good results with single subcutaneous injections of 10,000 I. U. of antuitrin-S. He found that strong estrum developed in from ten to 28 days following treatment. Similar results with chorionic gonadotropin have been reported by Woelffer[5] and Hinze[1], although these investigators also manually removed one or more cysts prior to the injection of the hormone.

Fincher[7] reported that 78% of the cattle he treated for cystic ovaries with chorionic gonadotropin became pregnant. Cysts were ruptured in about half of these cases and the other half conceived promptly within 50 days after the use of the hormone without manipulation of the ovaries.

Deubler[6], in another report, obtained good results following the intramuscular injection of 10,000 I. U. of chorionic gonadotropin, while Moore[3] found that if administered intravenously, many nymphomaniac cows will respond to one or two intravenous injections of 1,000 I. U. (one-tenth of the recommended intramuscular dose). Hinze[1] observed that more uniform results were obtained when 2,500 international units (I. U.) chorionic gonadotropin were injected intravenously at the time the cyst was ruptured and repeated in 48 hours.

It is noteworthy that the intravenous dose of this product was only a fraction of the intramuscular dose. If large doses of chorionic gonadotropin are given intravenously, Woelffer[5] feels it advisable to administer 5 to 8 cc. epinephrine hydrochloride to prevent allergic reactions.

Case Histories

Case 1. A four-year old Brown Swiss had calved five weeks prior to examination and had been in heat three times since freshening. Rectal examination revealed cystic ovaries. These cysts were expressed manually and 10,000 I. U. antuitrin-S were injected intramuscularly. Diagnosis of pregnancy was made on this cow two months after the first heat period following treatment.

Case 2. Holstein having irregular heat periods and bred seven times without results. Cystic ovaries were found on rectal examination. These cysts were expressed and 10,000 I. U. antuitrin-S were injected intramuscularly. Pregnancy was diagnosed two months after the next heat period after treatment.

Case 3. Holstein with an irregular estrous cycle showed cystic ovaries on rectal examination. Following drainage of the cysts, 10,000 I. U. of the hormone were injected intramuscularly. This cow conceived at the first service.

Case 4. On January 10, 1952 a two-year-old Holstein freshened but failed to come into

The author wishes to acknowledge cooperation in this study extended by Dr. J. R. Eggleston, Medina, Ohio.

®Parke, Davis & Company, Detroit, Mich.

heat. On April 11, 1.5 cc. diovocylin®[1] was administered intramuscularly. Estrum was observed the following day and the heifer was bred four days later. No conception on this service. On August 13, 30 cc. gonadin®[2] was injected intramuscularly with insemination performed four days later. Pregnancy resulted.

Case 5. A Hereford that had suffered previously from metritis and retained placenta had been treated with estrogens and uterine medication. Subclinical heat with symptoms of nymphomania were observed. Rectal examination revealed cystic ovaries. An intramuscular injection of 10,000 I. U. antuitrin-S was made. She was bred twice and was diagnosed as pregnant following the second service.

Case 6. Following treatment with 5,000 units of another chorionic gonadotropin without results, a Holstein cow suffering from cystic ovaries was given 10,000 I. U. antuitrin-S intramuscularly. Two months after being bred the third time, she was diagnosed as pregnant.

Case 7. Holstein calved in October, 1951. Six months later, and following several breedings without conception, she was given 10,000 I. U. chorionic gonadotropin intramuscularly. Pregnancy was diagnosed two months later.

Case 8. Holstein with an irregular heat cycle and a purulent discharge was treated with 10,000 I. U. antuitrin-S. Although the heat periods became normal, the discharge remained. Abbott's uterine medication also was used but the animal did not conceive. The cause of the discharge was not determined definitely.

Case 9. Holstein cow with an irregular heat cycle and slight discharge was treated with 10,000 I. U. antuitrin-S. Pregnancy resulted after three breedings.

Case 10. A Holstein cow that had recently aborted was manually cleaned and given 20 mg. diethylstilbestrol. Ovarian cysts and a purulent discharge were observed a week later. An intramuscular injection of the prescribed dose of hormone failed to effect normal conditions and she was shipped for slaughter.

Case 11. A Holstein cow that had freshened three weeks previously and had been in heat twice within four days and the day of treatment was given 10,000 I. U. antuitrin-S intramuscularly. She was bred subsquently and conceived.

®[1]Ciba Pharmaceutical Products, Inc., Summit, N. J.

®[2]Cutter Laboratories, Berkeley, Calif.

Discussion

Cows exhibiting symptoms of nymphomania due to cystic ovaries often will develop normal estrual cycles following a single intramuscular injection of 10,000 I. U. of antuitrin-S.

In 11 cows which received this chorionic gonadotropic hormone nine responded to treatment. No intolerance was noted in any of the animals.

Best results were obtained when the preparation was used in animals showing symptoms of nymphomania for not longer than two weeks, and in the absence of purulent discharge or pathology other than cystic ovaries.

Nontypical cases of nymphomania often respond to antuitrin-S, indicating that infertility is due often to a combination of conditions.

Recent research has prompted the writer's use of hi-amine compound®[3] or some other form of iodine as supplemental treatment in many cases of ovarian cysts. Eggleston[8] has used iodines in an artificial breeding program with excellent results.

Summary

1. Failure of estrum frequently occurs in cattle and causes considerable economic loss.

2. The intramuscular injection of 10,000 international units (I. U.) of antuitrin-S offers another method of treating nymphomania in cattle effectively when due to cystic ovaries, providing no serious pathology exists concurrently.

3. Best results were obtained when this hormone was injected early in the course of the condition, that is, not longer than two weeks duration.

4. By early treatment, the cystic condition can be corrected before there is a marked delay in the herd's breeding program.

5. In uncomplicated, early cases of nymphomania, over 90% correction was observed. Data shown in this paper indicates a slightly lower recovery rate since some of the cases were complicated by a purulent discharge.

6. Hi-amine compound also was used in some of the cases, while others responded to hormone therapy alone.

(Continued on page 194)

®[3]Pitman-Moore Company, Indianapolis, Ind.

Veterinarian's Fee Problems†

KENNETH B. HAAS,* Sr., Ed. D., Chicago, Illinois

MANY veterinarians have an emotional block when the topic of selling their services is mentioned. Too many think that they should not be merchandisers. They feel, in a vague way, that professional service and money can not wed. So, like Alice in Wonderland, they walk in a dream world of unreality. Obviously, the veterinarian who is averse to the fee question is too shy, too impractical, or too inefficient to succeed as a practitioner.

It is equally obvious that the selling of one's service includes many concepts that are accepted as ethical by even the most conservative professionals and are employed by all who have had a minimum of business education. Moreover, the proper assessment of fees is one of the most important factors in the conduct of a successful practice.

To earn his fee, the veterinarian must offer something of value. To offer something successfully, requires a high degree of salesmanship. Good salesmanship spells the difference between success and failure in a great majority of practices.

Salesmanship, to the veterinarian, means influencing the mind of the client by offering him something beneficial. To influence a client, the veterinarian must know how to: (1) Evaluate the client's mind; (2) answer excuses, objections and questions; (3) anticipate and guide mental and emotional resistance; (4) emphasize quality of the service; (5) convey confidence; (6) ask for and collect fees; (7) deal with competition and fees; and (8) charge for dispensary items.

These are the major topics related to selling professional services. The first item in the above list is important, for unless the doctor understands and appreciates the mind and behavior of his clients, he can not be a successful salesman.

The Mind of the Client

All merchandisers, of all products, meet mental and emotional resistance in customers when a product or a service is being bought and sold. Veterinary practice is no exception. Therefore, a practitioner's clients offer the same kind of mental resistance to him as they do to the butcher, baker, and candlestick maker. Such client resistance is an inherent, and usually an unconscious, protective device that is employed automatically when it comes in contact with a vendor of services or merchandise. This protective device is revealed in the form of excuses, objections, and questions.

Psychologically, excuses, objections, and questions are merely the client's way of obtaining further information or of reassuring himself about the quality, quantity, or price of the professional service or product. He wonders if the treatment will be permanent, so he says, "I believe this treatment is not worth the money." He actually wants the veterinarian to show him, to reassure him,

†From an address delivered to the Southern Veterinary Medical Association, Asheville, N. C., Oct. 18, 1954.

*Chairman, Department of Marketing, Loyola University, Chicago.

Part of the content of this article appears in the book Business Practices in Veterinary Medicine, by Kenneth B. Haas, Sr. and Kenneth B. Haas, Jr. Published by Veterinary Medicine, 803 Livestock Exchange Building, Kansas City 2, Missouri.

that the treatment is worth the fee and will be permanent.

When a client does not ask questions, or raise a few objections, there is usually something wrong. Inquiries should be welcomed, for they bring hidden feelings into the open and allow the veterinarian to allay fears. Objections and questions prove interest; therefore, they are welcomed by creative practitioners, who should never worry, or appear disgusted or discouraged when they are offered.

Importance of Consultation to Clients

If he satisfied every client who requested his services, the veterinarian's work would be easy. But clients are not satisfied that easily. Possibly the veterinary profession has a higher percentage of inquisitors than any other business group, particularly if the clients are chiefly women.

The practitioner constantly must keep in mind that paying fees for treating animals is relatively new. Not too many years ago, veterinary practice was performed by neighbors, the owner, or more often was entirely neglected. Paying fees for professional service may also represent an important decision for the average animal owner. Veterinary service is not bought like chewing gum. Mr. Client may proceed cautiously. First he may "shop the market" to discover how much he must spend. Then when he (or she) has decided to call on the veterinarian he may have to consult with his wife or even the family. Quite often the wife is called in to assist in making decisions or to observe the treatment.

Leaving a Good Impression

The "shoppers" can be irritating, but when the veterinarian recalls that their economic and social position may be critical, he can afford to be broadminded and tolerant. He should never lose his temper, or appear disappointed if the client walks out without "purchasing." If the doctor has been a creative salesman, the client will be back when he is ready to pay the fee. Even when the doctor is disappointed at losing a fee, he must not show it, but leave the client with a good impression of him and his practice. Most clients appreciate good service and a helpful attitude. If they feel that they are being treated fairly they will remember it the next time they need professional advice and help.

Methods of Master Salesmen

If I were a practitioner I'd employ the methods used by master salesmen in dealing with objections, resistance and reluctance to pay fees.

Master salespeople know that real obstacles arise when a client is interested, but fearful. They know that "ignorance is the father of fear". They know that the only way to remove the fear on the part of the client of being "taken" or overcharged is to "educate" the animal owner.

When you encounter a real obstacle to fulfill, what should you do? *First, relax physically*, but not mentally. Don't be afraid of resistance, reluctance, and complaints about an established fee. Simply recognize that they are signals on the part of the client that he has certain fears and expects and wants you to help him feel that they are groundless.

Second, listen to the complaint; drag it out into the open. Your client wants to be understood. He doesn't want an argument. Let him know that you believe his thought is worth listening to with respect. Encourage him to get it off his chest. Show by your attitude that you respect the stand he has taken. Never forget that by getting it off his chest he deflates the complaint obstacle. Repression inflates the obstacle. When you listen, he is telling you what is in his mind and is giving you the information you need to nullify his fear and make him satisfied with the fee asked.

How much better that Mr. Client *voices* his questions instead of just *thinking* about them and forcing you to probe in the dark. You can't change an opinion when you don't know it exists.

Master salesmen respond by providing the information asked for clearly, completely, and with an understanding of the client's viewpoint. Here we have the core of the whole fee objection "bugaboo"; that is, an understanding of the client's viewpoint. With his mind open and receptive you are now ready to provide the information he wants. In providing the information let's remember one thing: No person resists when he feels certain that he will benefit through being your client. The only time a client resists is when he feels certain that something is being taken away from him. When he feels that he is "putting out" something without getting back an equal or a quarter value, he resists. But who wouldn't?

So let's consider this fact. Your client in reality doesn't want your services. He wants what they will do for him! If you keep his mind on the "receiving end" — his thoughts concentrated on what he is "taking in" — you

will keep him thinking in terms of plus values — addition.

Addition warms him to your suggestions. On the other hand, if you allow him to think in terms of what he is "putting out", that is, in terms of subtraction, he will freeze you out. He doesn't like subtraction. He is interested only in adding up personal advantages. So, in handling complaints and objections remember to add benefits to benefits — each one warmer and more closely related to the client's interests.

The third thing to do is use assurance phrases. For example, "Mr. Jones, I can understand why you feel that way. In fact, several of my most satisfied clients once felt exactly as you feel. But now that they see the extra profits they have made from this treatment they are asking for it".

Other assurance phrases may be used by veterinarians; for example:

"That is a perfectly natural thought . . ."
"I can understand your viewpoint . . ."
"Yes, I see your position . . ."
"That's an important point to consider . . ."
"I'm glad you brought that up . . ."
"That is certainly a logical conclusion . . ."
"I can see how you feel. Others have felt the same way until . . ."

Be sure to use assurance phrases that suit your personality and the situation. Use those which roll off your tongue easily without having to think of them. Don't be afraid of repeating your assurance phrases. Be sure that they roll out naturally and are spoken with quiet assurance.

When you use assurance phrases with your explanation you show that you understand the client's position. You show that you sympathize with him. You show that you do not necessarily agree with him. You have time to reopen his mind for further decision making. You have time to figure out a solution for his complaint or reluctance.

Further, this method shows that you respect his thinking. Never argue, remembering what Charles Schwab once said, "Winning an argument never put a dollar in my bank account".

Finally, if I were a practitioner, I'd have a small sign on my office wall, or on the top of my desk which would read: *"Pecunia non est."*

▼ ▼ ▼

Supplies of feedstuff for all classes of meat-producing livestock are estimated to be more than ample for the spring season.

American Animal Hospital Association Annual Meeting, May 4-7, 1955

Program planning for the 22nd annual convention of the A.A.H.A. is now complete and assignments have been accepted by a group of well-qualified persons, according to report of Dr. L. K. Firth, practitioner, Canton, Ohio, chairman of the Program Committee. This meeting will be a practical one for those interested in small animal practice. A generous portion of available time will be devoted to subjects having to do with business practices, case records, relations with clients, and other related problems that influence client acceptance of facilities provided. Other features will include research reports and, as anticipated, will direct attention of all to therapeutic approaches not previously explored.

Again this year closed circuit television will be employed for clinical demonstrations which have proved so popular in the past. This portion of the program will be sponsored by the Radio Corporation of America and Allied Laboratories.

Sessions will be held in the Hotel Statler, which will afford superior accommodations for housing and for meetings. Because of the central location for this year's meeting place, a record attendance is expected. Those planning to attend are urged to make their reservations early. Dr. Wayne H. Riser, 5335 Touhy Avenue, Skokie, Ill. is executive secretary.

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Interest in Purebred Dogs Increasing

Public interest in purebred dogs has been increasing markedly since 1948, according to report originating from the Gaines Dog Research Center.

A record of 346,525 dogs were registered in the A.K.C. during 1954, which number is nearly five times that of 20 years ago and represents a gain of 7% over 1953.

During the past 30 years, dog numbers have increased by 200% while the population figure increased by 50%.

Registration of Beagles topped all other breeds for 1954. Boxers were second and Cocker Spaniels, which led all breeds for 17 years, rated third highest in numbers of puppies registered.

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A.V.M.A. 92nd Annual Convention Minneapolis, Minn., Aug. 15-18, 1955

Ischuria in Cats and Dogs

W. F. HOFFMAN, V.M.D., Pittsburgh, Pennsylvania

The problem of retention of urine in cats and dogs is a challenge to the practitioner. Many animal owners apparently do not recognize the early signs of urinary distress exhibited by animals so afflicted. A history of straining is usually offered and not infrequently the owner has administered a cathartic, because of his or her belief that the animal is suffering with constipation. Such therapy, and the fact that urine retention has been present for a variable period of time, in some instances a day or longer, finally develops into a serious situation.

The precise etiology of ischuria is unknown. However, urinary calculi as well as definite mucus plugs frequently are found in the urethra. Mucus plugs are found often in cats, while calculi are observed more frequently in dogs.

In this clinical report we do not propose to explain the etiology of ischuria, but rather our method of management. This method also has been outlined by Schein[1]. It is hoped that our procedure may be of value to other veterinary clinicians.

As previously indicated, urine retention may be present for variable periods. This factor may influence our procedure for treatment.

Immediately upon the determination of urine retention we administer intramuscularly 1.5 to 2.0 cc. of depropanex®. This product, a deproteinated pancreatic extract, usually will relax the urethral wall or blood vessels in the wall of the urethra, so that urine will escape or relaxation will occur which will permit easy passage of a catheter or bougie. The bladder thus may be drained, or if calculi are present, they may be dislodged to allow escape of urine.

We have found that the daily administration of this agent for three days, usually is sufficient to provide effective drainage of urine from the badder. If the bladder is greatly distended and drainage does not appear satisfactory following treatment paracentesis vesicae is performed. In this manner we remove some of the urine, reduce tension on the bladder wall, and facilitate the passage of the catheter or bougie. The after-treatment consists of oral therapy with acidifying agents and 25,000 units of vitamin A every other day. Injections of depropanex are helpful in removing urethral calculi in dogs prior to surgical intervention for its effect of relaxation. Continued use of the agent for two or three days after operation prevents attacks of dysuria.

Depropanex has been found useful also in relieving dysuria due to hypertrophy of the prostate gland in dogs. This treatment, of course, is effective only in the acute stages and must be followed by other therapy, such as administration of hormones or surgical measures.

During the past five years we have used

(Continued on page 189)

®Sharp & Dohme, Inc., Philadelphia, Pa.

Dr. William G. Magrane, (right) Mishawaka, Indiana, receives his "Fido" (dogdom's equivalent to Hollywood's "Oscar") as Veterinarian of the Year 1954 from Harry Miller, director of the Gaines Dog Research Center, at ceremonies held in New York in connection with the great Westminster dog show. Doctor Magrane was voted the honor in a nationwide poll conducted by the Center.

Legal Liability And Malpractice Problems†

C. T. FINN, Attorney, New York, New York

BEFORE considering the legal liabilities that may attach to doctors of veterinary medicine, one or more of three legal subjects generally are involved: The law of contracts, the law of agency, and the law of torts.

There are a great many branches of law, and one must understand that these are only a few of them. The three that interest us most are the three just enumerated.

Law of Contracts

The law of contracts has to do with rights or duties that may arise as the result of legally enforcable agreements entered into by two or more parties. A contract may be oral or it may be written or it may be implied.

An oral contract or a written contract, usually are the source of little litigation. For example: If I come to you and ask you to vaccinate my drove against cholera, and you do that, and I refuse to pay you, of course you have a cause of action against me on the contract. By the same token, if having agreed orally to do it you refuse or fail to do it, my action is against you for breach of oral contract.

There is no difference between an oral and a written contract, except that the oral contract is more difficult to establish.

The written contract, of course, is the one where two or more parties enter into the formality of a written instrument, where one agrees that, in consideration of the services to be performed by another, a certain sum is to be paid for those services. Such contracts are the object of little litigation.

The implied contracts are the ones that are more troublesome. For example, I would say to you, "Come and inspect my herd and do what is necessary." You come and inspect them and you feel that what is necessary is vaccination, and other things that you do, and you send me the bill. Here I have not actually agreed to pay you for vaccination. I have not agreed to pay you for the other services. But here the court will say, without any doubt, that there has been an implied agreement on my part to pay you for the services that were necessary, and there was implication that that was the intention of the parties.

There is one other type of situation which is not actually a contract at all. It is a storm cellar for the courts to help them enforce justice in situations where equity demands that an agreement be enforced.

These situations are known as quasi-contracts, fictitious contracts. Suppose that my neighbor is away on this particular afternoon and I see his dog badly injured. I call you. You answer my call and, having treated the animal, you send your bill to the owner. The owner writes back and says: "Dear Doctor, I have received your bill. I have no recollection of engaging your services. I am quite sure that I never agreed to pay for any such services, and I suggest that you send your bill to Finn. He is the one who engaged your services."

The court says, in those cases, that there is a contract between the owner and the doctor. It is a quasi-contract. It is a fictitious contract, but to refuse to enforce such a contract woud be inequitable. It would permit the owner to achieve unjust enrichment, to receive the benefit of the services without being called upon to pay. And the courts justify this fictitious contract by saying that had the owner been present, the owner would have done the thing that was done under these circumstances.

So then, keep in mind that one of your liabilities may be a contractual liability. Never say, for example, "I will cure the animal." If you say you will cure the animal, then you contract to cure the animal, and if you do not cure the animal, you are guilty of breach of contract.

Therefore, you should agree to put forth your best efforts. You should agree to anything along that line that seems reasonable. But you should not agree to cure unless you are morally certain, or want to take a chance that you actually can effect complete recovery.

Law of Agency

The law of agency is a branch of law that deals with the legal rights arising when some-

†Presented at the 21st annual meeting, American Animal Hospital Association, New York, N. Y., May 5-8, 1954.

one else acts for you. The persons who may act for you will be in one of three classes. They will be: (1) Agents, (2) employees, or (3) independent contractors. We can lump the agents and the employees into one group because the legal results are the same.

The agent is the individual who is to perform a certain act for you. Buy me a house, get me a car, sell my house, get me a contract of insurance; it is a particular act that he is doing for you. A partner is a general agent for other partners for any act within the scope of the partnership business.

The principal, the one who engages the agent, is responsible for the wrongs committed by the agent, is based on the theory that the master is responsible for the action of his servant. The same rule applies to the employer in that he is responsible for the acts of the employee.

The assistant in your organization who is making a delivery by car and strikes a pedestrian has committed an act for which liability will attach to you. All-assuming, of course, that the acts are committed within the scope of his business, when he is actually working for you. If he is going to church on Sunday with the family and strikes a pedestrian, you are not responsible. That is not part of his job.

The other group who may be in your service is independent contractors. They are responsible for their own wrongs and you are not responsible.

Sometimes I engage someone to work for me or to do things for me, or you engage people to do things for you where you are contracting for a result. You exercise no supervision over their activities.

For example: I say, "Put a new roof on my house." I know nothing about putting roofs on houses, and I am not interested in learning. All I want is a roof on the house.

In that situation, if the independent contractor putting the roof on the house drops the hammer on the milkman's head, he is responsible, not I. By the same token, if the man who is repairing the roof is my agent, if I say "Joe, put the new roof on there. Start over on this side, and work this way. Here are the shingles, and here are the tools. I will pay you $10. a day, and I will come along every now and again to see if you are doing it the way I want it done", then he is no longer an independent contractor. Now he is an agent, and I am responsible for his wrong. If he drops the hammer on the milkman's head, I am responsible for that wrong.

Veterinarians, physicians, dentists, lawyers, and registered nurses are, in the vast majority of cases, independent contractors and are responsible for their own torts, or wrongs.

Torts mean civil wrongs as opposed to crimes. There are many kinds of torts, many kinds of civil wrongs.

Slander. You call me a shyster lawyer and it does damage to me. This is a tort for which I may bring an action against you for damages.

Libel. You write it in the paper. That is a tort.

Assault. You threaten me with bodily harm. That is a tort .

Battery. You actually do physical harm to me. That is a tort.

Nuisance. The unreasonable use of your property to the detriment of another. The chemical plant that directs its waste material into the town water supply is a nuisance.

Negligence. The failure to exercise reasonable care for the protection of the person or property of another.

Malpractice. The failure to exercise the skill and judgement which is required of those entitled to engage in a profession.

The two that concern us most are negligence and malpractice. So then, let us consider the criteria that the court uses in determining whether or not a doctor of veterinary medicine, or anyone else, has been guilty of an act of negligence. Keep in mind the fact that there has been a lot of damage does not mean that there is any cause for action. There must be both negligence and damage. One is not enough. (1) You are not required to accept any case. You may refuse for any reason, including the reason that you do not think that you will be paid. You have no legal obligation to render any service even in the presence of an emergency. Maybe you have a moral obligation; you probably do. But you have no legal obligation. (2) Upon accepting a case, you do not impliedly agree that you will effect a cure. As was mentioned, you may expressly agree, if you choose, but by merely accepting a case you do not contract to effect a cure.

The liability or responsibility of doctors of veterinary medicine is the same as that of a physician or surgeon. You are required to possess the knowledge and skill and to use the degree of diligence and care required of individuals in the same class in your particular locality. When you accept a case, you impliedly agree that you possess skill and that you will exercise diligence. If you fail to

possess the skill, or if you fail to exercise the diligence, there may be an action against you for negligence if damage results.

The plaintiff (the owner of the animal) need not prove that you were grossly negligent or wilfully negligent. He needs only proof that you failed to possess the skill expected of a member of the profession in your locality, or that you failed to exercise reasonable care in the employment of that skill.

You are not required to have any extraordinary skill that might be possessed by a few outstanding members of the profession. It is no basis of a claim for a plaintiff to say that had this operation been performed by so-and-so the result might have been different. The fact that the services are gratuitous, that you are doing it for nothing and do not expect to get paid, in no way changes or lessens your responsibilities.

You are not responsible for, or expected to anticipate, new discoveries. If the treatment which was given was a generally recognized treatment at the time it was given, there is no basis for a claim against you merely because at the time of the trial the treatment which was then rendered is now contradicted. All you need be concerned with is that the treatment you render is recognized by your profession at the time it is rendered.

The school that you attend is immaterial as far as your liabilities and responsibilities and the obligations are concerned. If you fail to possess the skill, or if you fail to exercise the prudence and care that is required of you, you may be liable to the owner of the animal even though a cure was ultimately effected. For example: You are treating an injured animal and an improvement is noted. A week later the animal is brought back and his condition is worse. You treat him again, and improvement is noted. He is brought back to you a third time, and on the third examination you find a deeply imbedded foreign body that you had not noticed before. This time you remove it and there is an ultimate cure. You are still responsible for any damage that can be shown which resulted from the ineffective treatment rendered on the first two instances, even though the animal ultimately recovers completely.

This liability continues as long as the employment (the engagement between yourself and the owner) continues or until it has been terminated by the owner or by mutual consent. You may not wilfully abandon a case once you have undertaken it, and this is so even though you are doing it for free; even though it is gratuitous.

You are not liable for an honest error of judgment. That is a great big subject, but it simply means that if you have the skill and you use reasonable care and your judgment is in error, you are not responsible for damage. Mere error of judgment is not a proper basis for an action for damages. You are not relieved for the results of your negligent treatment even though subsequent negligence of the owner intervenes. Suppose, for example, that infection follows trimming of ears, which was done negligently. Following this period in which the animal was having difficulty, the owner mistakenly gives him some food which is poison, and further disables him for an extended period. That in no way relieves you of the responsibility for the negligent act performed by you. The failure of the owner to obey your instructions as to the care of the animal reduces the damage only, but does not eliminate your liability.

Suppose that you inject with the wrong serum, causing difficulty, and the owner then leaves the animal exposed to cold weather, contrary to your instructions. It will be a question of fact, and a difficult one to resolve as to how much of the damage resulted from your treatment, but the basic liability still remains. It is your duty, as the doctor of veterinary medicine, to notify those people attending the animal of the nature and character of the disease, and to warn them of any accompanying dangers, and you will be liable to people who are injured whom you have not so warned. This includes, tuberculous cattle, dogs affected with rabies, or suspected of being infected with rabies, et cetera.

A Client Becomes a Plaintiff

These, in general, are the main points that the court looks for when it is confronted with a situation where it is claimed that a doctor of veterinary medicine has been guilty of negligence or malpractice. I have tried to pick out three situations that appear to be the most frequent ones, the common basis for claims against your profession.

The first one is the situation where an animal escapes from the custody of the doctor of veterinary medicine. This is a matter of negligence. It is not malpractice. The keeping and custody of an animal is not treatment.

Negligence is mainly a question of fact. The law of negligence is a cinch. Did you use reasonable and ordinary care? If you

did, you have not been guilty of any negligence. If you failed to exercise care, you are guilty of negligence. That is the law of negligence.

Facts are the difficult things; whether or not you have, as a matter of fact, been guilty of negligence. Supose you have a Wolfhound in your custody; and you have him in an enclosure with a five-foot fence, and he jumps over and escapes. I think you have been guilty of negligence. I think, as a doctor of veterinary medicine, you should be aware of the fact that a Wolfhound who is inclined to do so can jump over a five-foot fence, and I think you would be responsible in that case.

Suppose, in the same situation, the fence is struck by lightning, or it is damaged by fire not caused by any negligence of yours, and the dog escapes. Here there is no negligence on your part, and you are not responsible, the lightning being an act of God, and the fire being damage which was not due to your negligence.

Suppose that the dog is being brought to your institution on a leash provided by the owner, and the dog makes a sudden lunge and the leash breaks and the dog escapes. There is no liability on your part. You didn't provide the instrumentality that enabled the dog to escape. That is negligence on the part of the owner, not yours. Suppose you have him on a leash you provided and the leash breaks. Obviously, you are the one guilty of the negligence in this case.

Suppose you have him in a truck or car that you have provided and he escapes. In this case you are negligent. You should have taken necessary precautions for restraint. On the other hand, if the animal escapes while being brought in by the owner in his own car or truck there is no negligence on your part. It is merely a question of fact as to whether, in each particular instance, you were or were not negligent.

The second group of cases which appears to be fertile ground for litigation are those instances where the animal is injured by another animal, both being in the institution at the same time. Here again we are confronted with troublesome questions of fact. Suppose you, as the doctor, just put two dogs together in an enclosure; they fight and one of them loses an eye. In all probability you have been negligent.

Suppose some outsider, a dog owner, comes in and, mistaking the cage for the kennel where his own dog is quartered, he opens another one, the dog gets out and bites him or injures another dog. There is no negligence on your part inasmuch as it was an act over which you had no control.

The third type of case is strictly malpractice, improper treatment. Suppose you treat a drove of hogs for cholera; bad results follow vaccination and the owner then alleges that the hogs had "necro", that they did not have cholera at all, and that one reason the ailment was diagnosed as cholera was because the hogs revealed low temperatures, one of the cardinal signs of necro.

Here you did not do anything negligently. Your actions were intentional and careful. Your examination indicated that they had cholera, and you vaccinated as would normally be done in instances of cholera. However, you did not possess the skill that is required in your profession, and you should be charged with malpractice.

Assume that you have treated an animal bitten by a dog infected with rabies. You administer the Pasteur treatment to the animal bitten and you keep it in your custody for ten days, after which you return the dog to the owner. The owner calls you the next day and says, "The animal seems quite unwell." You say, "Bring him back immediately." The owner delays for three days, and on the third day the dog bites him. There is no liability on your part, nor is there any obligation to take the dog away from the owner forcibly. You have done everything required of you under the circumstances, and you can not be charged with malpractice or failure to exercise necessary skill and care.

Who do you suppose is responsible for about 75% of all malpractice charges against doctors, dentists, and doctors of veterinary medicine? The doctors, the dentists, and the doctors of veterinary medicine are responsible. In such instances the M. D. will say to the patient who comes to him, "Who operated on you? The local butcher?" The dentist will say, "Don't tell me a dentist did that to your mouth." The doctor of veterinary medicine will say, "What have you been trying to do, treat him yourself?"

Those are the things that give people ideas. Even if you think it, do not say it. Just remember that the propaganda started by the three professions is responsible for a vast majority of the litigation that is instigated against you.

Open Reduction of a Complete Luxation of the Elbow

R. H. GUMP, D.V.M., and H. W. HEISER, JR., B.S., D.V.M., Wichita, Kansas

On November 16, 1954, a valuable five-year-old, male, English Setter was presented with a history of having been lame in his left front leg for the previous six weeks. The owner had left this dog in the care of a trainer, who had been working him regularly. The trainer had noticed that the dog was becoming increasingly lame, but had attributed it to sore pads, and had continued the training program.

Upon initial examination, it was apparent immediately that the left elbow was completely dislocated. The entire elbow region was greatly thickened, motion was quite limited, and there was noticeable atrophy of the muscles of both upper and lower arm. A radiogram of the part showed the radius and ulna luxated laterally to such an extent that the head of the radius was in bare articulation with the lateral condyle of the humerus. The semilunar notch was partially obliterated by bony tissue, and spicules of beginning bone formation were evident surrounding all elements of the joint. (Fig. 1).

The animal was anesthetized and manual reduction attempted, with little hope of success. Reduction could not be accomplished. After numerous attempts, it was obvious that the articular surfaces were incongruous and that this method offered no chance of successful reduction. Following considerable discussion and study, it was decided that the only plausible alternative was to attempt open reduction.

Surgery

During the following week, the dog was anesthetized again with pentobarbital sodium, and a sterile field prepared, from the point of the shoulder to the carpus. A tourniquet was applied around the upper arm, and the foot and lower arm covered with sterile stockinette. After a review of the anatomy of the region, it was decided that in order to gain good access to the articulations and yet avoid the main vessels and nerves of the region to make the major incision on the postero-lateral aspect of the elbow.

The skin was incised from a point approximately three inches above the point of the elbow, extending distally across the postero-lateral aspect and terminating approximately two inches below the point of the elbow. Medial and lateral skin flaps were reflected, exposing posteriorly the aponeurosis of the triceps attached to the olecranon, and laterally a mass of fibrotic tissue, from which the

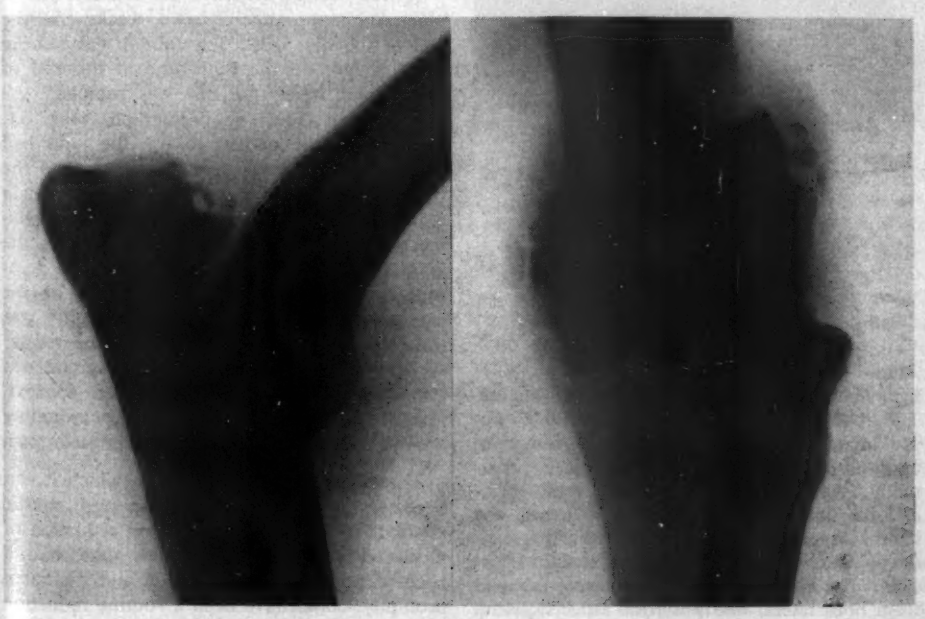

Figure 1.

Figure 2.

Figure 3.

ligaments of the joint were indistinguishable. The aponeurosis of the triceps was divided approximately one half inch from its insertion, and the body of the triceps reflected proximally. An attempt was made to remove excess cartilage and fibrous tissue from the lateral aspect of the joint and still preserve the joint capsule; this was found to be impossible. The articular surfaces now were exposed from both lateral and posterior aspects, giving excellent access to the entire joint.

The lateral condyle of the humerus was flattened considerably at its most distal extremity; apparently this was the only area of articulation during the time of the dislocation. The semilunar notch was filled in largely with cartilage and fibrous tissue, as was the olecranon fossa and the capitular depression of the radius.

By means of curettage and rongeurs, the greatest part of the excess tissue in the semilunar notch and olecranon fossa was removed. An attempt to reshape the capitular depression of the radius was unsuccessful. It thus seemed indicated to remove the head of the radius. This was accomplished with a bone saw, removing a segment approximately one half inch in length.

As far as could then be determined, articulation between the humerus and the ulna was satisfactory. 200,000 units of aqueous penicillin were deposited in the joint, and a stainless steel pin was driven through the olecranon and into the medial condyle of the humerus to maintain reduction. (Fig. 2). The aponeurosis of the triceps was united with interrupted sutures of #0 extra chromic catgut, and the skin incision closed with interrupted sutures of dermal nylon.

It was decided to leave the fixation pin in place for approximately two weeks. At the end of the first week, the animal was bearing slight weight on the limb, and at the end of the second week, the pin was removed. As can be seen from the radiograph, (Fig. 3), attempts by the patient to use the joint had broken the pin between the humerus and the ulna, allowing its proximal portion to remain embedded in the medial condyle of the humerus. At the time the pin was removed, the animal had approximately 50% normal joint function, and reasonably normal use of the leg when walking. Muscular atrophy was rather pronounced. Reports from the trainer six weeks later indicated that the animal was improving slowly and steadily, had approximately 75% normal joint function, was getting around well, and recovering good muscle tone.

This is the report of a case in which it was necessary to resort to unique and drastic methods to procure and maintain reduction of a severely luxated elbow. This case, had it been presented for examination and treatment promptly, could have been a routine reduction without probable ill effects.

The Management Of Diarrhea Problems In A Monkey Colony

THOMAS B. SNODGRASS, D.V.M., Zionsville, Indiana

PRIMATES brought to this country from their native habitat frequently develop diarrhea complicated by anorexia and dehydration. This problem has been serious especially with the rhesus monkey. Various investigators have reported on the etiology of enteric disorders in primates[1,2,3,4,5].

Because of the nervous temperament of these semi-wild animals, manual or individual medication frequently is not practical. For ease and convenience, medication in the drinking water is preferred. As a rule, sick individuals that will not eat, do continue to drink.

To combat the diarrhea syndrome in our colony, we have used a new antidiarrheal powder, entromycin®[a]. This powder has a chocolate color and odor, and the flavor is bland. This powder can be mixed with food, water, or milk with ease and apparently does not alter the food flavor when used in recommended amounts. The powder consists of roasted carob pulp (arobon®[a]), kaolin, black willow bark, and 200 units of bacitracin and 20 mg. of streptomycin per gram. These antibiotics are not absorbed from the intestinal tract in any significant amount and are effective against a wide variety of Gram-negative and Gram-positive bacteria[6,7]. A combination of bacitracin, streptomycin, and polymyxin-B has been used successfully to treat monkeys with amebiasis[8]. Proteus dysentery in dogs has been treated successfully with streptomycin[9]. Konde reported excellent results with bacitracin in treating canine diarrhea[10]. Carob flour has been used with marked success to control diarrhea in infants, since it supplies a high natural content of pectin, lignin, and hemacellulose[11]. Pectin and the other complex carbohydrates bind and remove toxins whereas kaolin absorbs bacterial toxins. Research studies in dogs and cattle have revealed that entromycin is extremely safe and the dosage can be varied widely to suit individual needs.

Method of Clinical Usage

Water fountains used in monkey colonies are of a gravity flow type suspended on the side of the pen for easy accessibility. The mouth of the fountains are 3½ in. in diameter and of sufficient size to hold approximately one pint of water. As the monkeys drink from this fountain, there is a replenishment of the water supply by a bubbling mechanism from

the tank. To medicate monkeys in the colony, we prepare a concentrated entromycin suspension by adding 8 oz. of the powder to 5½ qt. of water. The powder first is made into a paste with a small amount of water and then thoroughly mixed in the large container. A 6 oz. dose of the suspension is removed with a standard metal dose syringe and placed into the cup of the water fountain. In those cases in which the diarrhea syndrome is well established, this procedure is conducted twice daily for several days until the condition is under control. When the diarrhea problem is not too severe, once a day medication will suffice.

Comment

Evidence of diarrhea appears rapidly in our monkeys, usually in a matter of 48 hours after receipt. The stool becomes extremely liquid, so that we commonly observe the fecal ma-

[a] Pitman-Moore Co., Indianapolis, Ind.
[a] Nestle's Co., Inc., New York, N. Y.

terial flowing from the rectum as they hang from the sides of the cage. Animals in this condition quickly lose interest in their surroundings and have little inclination to eat.

To emphasize the effect of the medication program outlined on death losses, the percentage death loss is presented in fig.1. We were of the opinion that the entromycin-water program was responsible for maintaining a low death rate, since we know that others having monkey colonies similar to ours were experiencing severe losses. A weekly test was

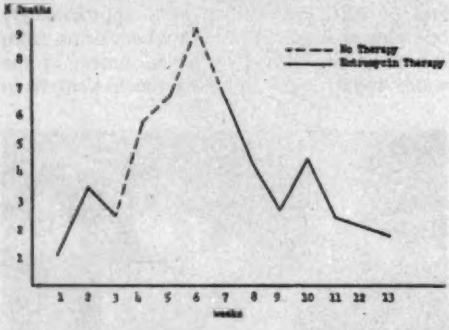

Fig. 1. Effect of entromycin-water medication on monkey death losses.

conducted on 13 separate shipments of monkeys. During this test, four groups of monkeys did not receive any medication. As revealed in the chart, death losses during this four-week period were considerably higher than any other weekly period when the entromycin was used routinely to control the problem.

There has not been any reluctance on the part of the monkeys to accept the medicated water. A small cereal pellet which contains high levels of vitamin A and C is used as the basic ration. In addition, the monkeys are fed oranges, carrots, and bananas. It should be pointed out that the monkeys included in fig. 1 are those that have been conditioned for at least three weeks prior to receipt, and are kept approximately seven days in our colony. These animals invariably are received in good physical condition and are free from signs of disease. The diet which we use in our colony is closely comparable to that which the monkeys are accustomed since arriving in this country. We do not believe that diet is the primary problem involved in this enteric condition, but we do suspect strongly that the stress factor resulting from transportation is extremely important and could be the underlying cause of the diarrhea syndrome.

It is possible that the organisms incriminated in this syndrome exist normally in the gastro-intestinal tract and when abnormal conditions are encountered the clinical situation develops. At the present time, the only practical method we have found, other than the water procedure, to medicate acutely ill individuals has been to mix the powder with crushed bananas. A teaspoonful of the powder can be mixed with one banana without any appreciable change in flavor.

Summary

Antidiarrheal powder, entromycin, consisting of roasted carob pulp (arobon), kaolin, black willow bark, bacitracin and streptomycin has been used with marked success to control the diarrhea syndrome in a monkey colony. The powder is added to the drinking water once or twice daily. Eight ounces of the new agent are added to 5⅛ qt. water and 6 oz. of this suspension are placed in each drinking fountain. A study of the death losses encountered, in comparing the effect of the entromycin therapy to nonmedicated water, revealed a significantly lowered death loss in the treated groups.

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Factors Affecting Radiographic Quality†

J. A. REYNOLDS,* B.A., M.A., White Plains, New York

IT is unfortunate that veterinarians and others have come to think that the matter of getting a good radiograph is something of an art that involves the mastery of some magic words or oaths, possibly even delivery of a kick at the right end of the *x*-ray machine.

I think that the reason for difficulty in getting satisfactory radiographic results is largely because technicians feel that the basic job or the basic criterion of success is to be able to get a good picture the first time and every time. Practically, this is an impossible goal to achieve. In the first place, one of the reasons for using *x*-rays is to visualize an unknown. Factors of milliamperage, time, distance, kilovoltage, screens (old and new), and temperature, not to mention the variables that are in the patient, influence final results.

It is quite obviously a big job to say, "I must be able to get a good picture every time I push the button." Therefore I feel that in a refresher of this nature, it is important to reestablish this fact: That the essence of being a good radiographic technician is not being able to take a good radiograph the first time you push the button, but in being able to take a good radiograph the second time you push the button. One will save time and money in terms of materials and time, if a radiograph is analyzed, and used as the basis for being sure that the next one is satisfactory. This is not difficult if one keeps in mind a few simple and basic rules. For many these are well known. However, by giving refreshment to the old ideas all may derive some help.

Quite obviously, if you have a radiograph that is not satisfactory, and you want to make another one that is, you must know what is wrong with the first. It is surprising how many people will say, "Well, I don't know what is the matter with this film. You can't see anything in it."

When one is dealing with kilovoltage, amperage, and time, one can not rush into correcting a deficiency in technic by simply saying it is all black. One should ask himself three questions: (1) Is the density of this radiograph satisfactory? (2) Is the contrast satisfactory? (3) Is the definition satisfactory?

Density. This is one of the major qualities on which a radiograph is judged. Density is the over-all blackness. Lack of density is the lack of over-all blackness.

Contrast. Contrast is the sparkle, the blackness and the whiteness of a pair of radiographs, and again it is hard to define but easy to demonstrate.

Definition. The third thing, of course, is the matter of detail or detail sharpness.

Density

Density, contrast, and detail are the three basic qualities of a good radiogram. These are the things that may be controlled.

One must recognize that there are factors that may be used to control density, and there are also factors that affect density without serving as factors of control.

The most useful for the control of density is time of exposure. It is the most usable factor because density is directly proportional to exposure time. Double the time of exposure, all other factors being equal, and density is essentially doubled. This is an easy thing to use.

One of the reasons film is wasted is that an exposure will be made, let us say for 0.7 second which may appear too dark. A second will be taken at 0.5 second. Difference is not appreciable. As a matter of fact, if you start out with the fact that this radiograph is too dark, and accept the fact that this one is just about right, you will see that when you use time as the factor to control density, change it in large factors rather than in fractional units.

For example, if a radiograph is taken with one second exposure and it is too light, repeat with two seconds exposure time, because small increments in time do not make directly proportional increments in density.

Not all of you have facilities in your equipment for changing the second control factor

†Presented at the 21st annual meeting American Animal Hospital Association, New York, N. Y., May 5-8, 1954.

*Technical Director, Picker X-ray Corporation.

in the density picture. Kilovoltage also controls density. The basic rule is that if you can change kilovoltage, increasing it by ten, will do about the same thing as multiplying time of exposure by two. In other words, there are two things that can change the density. Either increase the time of exposure, which incurs certain abilities as far as the patient's motion is concerned, or increase the kilovoltage for correction of too dark radiographs to improve the factor of density.

Many overlook the fact when they refer to their radiographic technic chart that another important factor which affects everything is the patient. No technic chart is made up for all patients.

Density also will be affected by the milliamperage. This, however, is not a satisfactory control factor. Nevertheless, if your technic chart calls for ten milliamperes, use it. If exposure time is doubled to make a different radiograph, see that the milliamperage is the same in both cases.

Sometimes insufficient care is taken to assure proper distance from the tube to the film. In this case a factor is introduced that affects density. Some try to control density by varying development time. This is a sure guaranty of unsatisfactory results.

Contrast

Contrast is sometimes misleading, in that the contrasty radiograph looks good, but frequently does not convey as much information as one which has no contrast.

Nevertheless, contrast is something that must be controlled because, in general, it will improve visibility of whatever detail may be present.

Rule 1. The factor that has the greatest effect on contrast is kilovoltage. Lower the kilovoltage and contrast will be improved. Raise the kilovoltage and contrast will be lost.

Therefore, in every case, one should try to use no more kilovoltage than is necessary to give the desired density in the desired time of exposure.

There is one thing that can be done to improve contrast which does not require appreciable adjustment of kilovoltage, and that is to use a cone.

The simple placement of a cone on the *x*-ray tube, that will limit the beam of radiation to a smaller part, will improve contrast measurably. This is something that is not appreciated generally and is so easy to do. I would recommend it most heartily, not only from the point of view of contrast, but also as will be mentioned later, from the point of view of protection against effects of radiation on the operator.

Occasionally, in institutions where large animals are patients, a grid serves a useful purpose. Fixed grids have a great effect on contrast but in small animal work, in general, are not required. In work with pet animals, benefit to contrast may be accomplished by using a cone, that many try to get by using a grid.

Remember, however, that contrast also is affected by the patient. The animal that is not active or that has been ill will have less opacity to *x*-rays than will the active animal. The inherent contrast of the patient may affect radiographic result.

By the same token, contrast can be affected by developing and processing conditions. Too high a temperature of developing solutions or old developer will cause lack of contrast.

Detail

As far as equipment is concerned, the principal factor that affects detail is the time of exposure. Wherever involuntary motion is involved, your radiographs must be made in as short a time as possible.

The patient often will determine this factor. There is one other factor affecting detail that is often overlooked, and that is the distance of the part to the film. For instance, if you are trying to take a radiograph of a leg, and instead of getting it as close to the film as possible, you tolerate a more comfortable position, where the distance of the part to the film is great, you will greatly diminish detail in the radiograph.

Intensifying screens and casettes are not devices that can be used to control detail, but they have a great effect on it. Care for casettes and watch out for the possibility of damage or warping. The net result of such damage is failure to bring screen in close contact with screen. Since about 80% of what you see on a film comes from the screen and not from the *x*-ray, those screens not in correct position will give a diffuse image in which detail is lost. Take good care of your screens and casettes. It is nonsense to buy a machine and then vitiate its utility by failing to take care of the accessories.

The Dark Room

The most important single factor in maintaining radiographic quality is the dark room.

Radiographs start in the dark room and end in the dark room. One must load the cassette in a dark room that is dark, and develop the film in a dark room that is dark. Going into a dark room from the outside and taking a quick look around is no way to find out whether or not it is dark. The film will tell.

When only an occasional radiograph is taken, the problem of settling in solutions may result in uneven and unsatisfactory development.

An even more important problem is the temperature of developer and fixer. Modern film can be developed with modern developers over a temperature range of about 60 to 90 degrees without getting into too much trouble. Care must be exercised to measure the time of development in accordance with temperature. This requires a simple floating thermometer. Developing time must be adjusted with solution temperature. Directions are printed on labels.

Following the rule for developing time will do a great deal to maintain radiographic quality.

Dangers of X-Radiation

The increased use of *x*-ray machines for all lines of endeavor including, industrial, medical, and otherwise, and the increased use of radioactive isotopes has brought to this country a strong consciousness of the dangers of radiation.

The Bureau of Standards and the National Committee on Radiation Protection is becoming increasingly active in calling attention to all users of any sources of radiation of the dangers to which they can be subjected.

In the radiography of small animals, it is altogether too easy to have your assistant or you yourself, hold the animal on the table while the radiograph is being made. The mere fact that technicians have not been injured by this practice is no reason it should be considered safe. Damage resulting from radiation often is delayed.

If a radiograph is made with an exposure of 80 kilovolts, for two seconds, which is an exposure common in veterinary practice, and if the patient is held in position while making the exposure, the operator will have subjected his hands to about twice the recommended weekly tolerance dose of *x*-radiation. The Bureau of Standards recommends that no individual, patient, operator, or assistant be subpected to more than 300 milliroentgens per 48 hour week. One single exposure may deliver to portions of the body more than twice that amount. Use lead gloves and aprons religiously. Use a cone whenever possible because, by limiting radiation to a small area, it is not only possible to get a better radiograph, but to reduce greatly the amount of scatter laterally from the patient. Enough radiation will be scattered from a small animal while making an *x*-ray of the femur to produce a radiograph of your hand on a film three feet away from the table.

In other words, this is radiation that you will receive. It is not a thing to be taken lightly, and I commend it to your attention.

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Research Grant for Feline Nutrition Study

Another year's study on the basic nutritive requirements of the cat will be handled by Rutgers University in New Brunswick, New Jersey, with the help of a $6,000. grant from the Mark L. Morris Animal Memorial Foundation.

The Morris Foundation of Topeka, Kansas, was organized several years ago to promote studies on the relationships of nutrition to the control of animal diseases and to promote graduate study in veterinary colleges.

Without basic information on detailed food requirements of small animals, particularly cats, veterinarians and animal nutritionalists find it impossible to develop sound and healthful diets, Doctor Morris says.

The rising population curve of the nation is paralleled by an increasing pet population, with an estimated 20,000,000 cats currently kept as pets in non-farm homes. Their daily consumption of prepared foods is rising steadily yet the supply of horsemeat, a basic ingredient in many pet foods, is disappearing rapidly.

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Ischuria in Cats and Dogs

(Continued from page 178)

the above procedure in the management of ischuria in 200 cats and 30 dogs, and of acute prostatitis in 30 dogs. Depropanex has been most valuable, and no toxic or untoward effects have been noted. Doses of 1.5 to 2.0 cc. are given intramuscularly and repeated at daily intervals, if considered necessary.

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Dry Skin or Summer Eczema in Dogs†

R. T. STAPLETON, D.V.M.,
Fayetteville, North Carolina

It is recommended that a thorough and comprehensive history be taken of each case presented for treatment of any abnormalitis of the skin or coat to included length of time the condition has existed and details regarding feeding. Examine the integument for parasites (lice, fleas, mange mites) and check fecal samples for ova of internal parasites. Treat as indicated.

If a parasite etiology can not be determined and in the event of scaliness accompanied by severe itching which may become raw and bleeding during summer months, dietary errors are suspected. In our experience cause is frequently found to be low fat and high protein intake. In 80% of such patients presented for treatment, diet has consisted largely or wholly of canned dog food, liver, kidney, eggs, or horsemeat.

Treatment begins with carefully outlined instructions for feeding which we insist must be adherred to without deviation. A diet of commercial dog meal with just enough horse meat to make an appetizing, moist meal is substituted for previous feeding practice. Bacon grease or lard is added (1 tsp. for small terriers; increase proportionately for larger animals). Beef fat is unsatisfactory because of its low lineolic acid content (beef fat, 2%; pork fat, 12%). Owners are impressed that recovery may be slow.

A product we refer to as "S and O", consisting of 2 lb. wettable sulfur, 8 oz. kerosene, 8 oz. turpentine, and 3 qt. peanut oil, is applied for the first five days of treatment. The dog is then washed and neatsfoot oil applied. These two agents are applied alternately. Forgan® (10 cc.) is injected routinely in these patients every five days until at least five doses or more, if indicated, have been given.

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Prevention of self traumatism is a most important consideration in the management of ophthalmic anomalies in dogs.

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†Presented at the 37th annual meeting of the Southern Veterinary Medical Association, Asheville, N. C., Oct. 18-20, 1954.

®Jensen-Salsbery Laboratories, Inc., Kansas City, Mo.

Leptospirosis

Recently we discussed, on this page, the incidence and nature of leptospirosis in cattle. Now, we have a request from a small animal specialist to discuss the ailment as it occurs in dogs. The following, gleaned largely from a Symposium on Leptospirosis, should be of interest:

1. There is some belief the Leptospira can not survive in acid urine of the dog. However, evidence is cited that even in urine having a pH of 5 to 5.5 Leptospira can live for from one-half to two hours. This is long enough, in large kennels at least, for infected animals to serve as spreaders. It is, however, correct that if the urine has a pH of less than six that the organism can not live in such surroundings for several days. Furthermore, treatment with such antibiotics as aureomycin®[1] or terramycin®[2] generally prevents the carrier state.

2. Immunization of dogs against leptospirosis is still in the experimental stage. A bivalent serum (*L. canicola and L. icterohemorrhagiae*) is available commercially and claimed to have decided therapeutic value in the canicola infection—less so in the more virulent icterohemmorrhagiae type. It is said that, with this serum, the mortality rate may be reduced from 50 to 5%, and the incidence of chronic nephritis frequently averted. Also, from the research standpoint, a vaccine prepared from *L. canicola* has given a high level of protection in experimental animals.

3. Treatment of dogs with antibiotics, aureomycin and/or terramycin, late in the disease, that is five days or more after its onset, is seldom helpful, though when used in the early stages effects frequently are dramatic.

Finally a word about symptoms of this disease in swine. The usual onset is accompanied by symptoms of an intestinal upset such as diarrhea, soon afterward there is fever and, not uncommonly, irritability which may culminate in epileptiform-like seizures. Less frequently ptyalism and epistaxis are noted. Other symptoms are turning of the head from side to side and rabies-like attacks of rage.—*R. R. Dykstra, D.V.M.*

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Feed formulation should be confined to nutritional factors.

®[1]Lederle Laboratories Division, Pearl River, N. Y.

®[2]Chas. Pfizer & Co., Brooklyn, N. Y.

EDITORIAL COMMENTS

Bovine Hyperkeratosis No Longer a Threat

Hyperkeratosis, that mysterious disease of cattle of such concern to scientists a decade or more ago that it was designated as "X", now has been so reduced among dairy and beef cattle that it is no longer a threat to growers. Etiology evaded investigators for years while the disease, ultimately discovered to be a toxicosis, killed tens of thousand of cattle and reduced the value of many more.

Successful control may be attributed not only to the energy and sincere efforts of researchers alone, but to the fact that these efforts were organized and the search for cause coordinated for efficient progress toward understanding of a pathological process.

Many persons and groups deserve honor awards for contributions toward such complete success in so short a time. Hyperkeratosis is almost unheard of today in well manged livestock operations. It is recalled that a special office was set up in the BAI in Washington, not for investigational work, but to coordinate and assign phases of comprehensive research to experiment stations in many sections of the nation. Dr. C. D. Lee proved the wisdom of the idea and hyperkeratosis ceased to be a problem. Not to be overlooked is the cooperation of oil companies who not only conducted research work at their own expense but who recognized promptly the dangers of additions to their manufactured products and removed them. Chlorinated naphthalenes are not now used in feed processing plants or in greases designated as agricultural petroleum products.

The saga of this conquest and savings accomplished for the growers and consumers of meat products is written in the pages of scientific papers. It is not clear to the man-on-the-street that veterinarians have made a significant contribution from which he and his family benefit. Perhaps it was nothing more than the job of a detective but the completed task is worthy of the highest praises to all of those who quietly devoted themselves to a project out of which has grown understanding and from which so many have and will continue to benefit.

Hidden Losses

Livestock authorities agree generally that all livestock in every part of the country carry a parasitic load that is deflecting downward potential growth, gain, and quality of meat-producing animals. Losses suffered are considerable, as outlined in Losses in Agriculture (A.R.S. 20-1, USDA). A conviction has gained momentum among veterinary parasitologists that losses preventable under modern sanitary management practices and use of anthelmintics available may amount to approximately 10% of annual livestock production, or a loss conservatively estimated at over $200,000,000.

Practitioners are encouraged to be mindful continuously of the drag of parasites and the many ways their activities affect the profit of clients in breeding operations. Prevention programs are simple and effective. Treatment after development of clinical signs of parasitism may not avoid delayed losses.

Hidden losses no longer need be tolerated.

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Hornfly Control

A quick and simple method for hornfly control that is acceptable for dairy cattle has proved effective in USDA tests. A tablespoonful of 50% methoxychlor (Marlate-Dupont) is sprinkled along the back of an animal and then spread around and rubbed into the hair with a few sweeps of the hand. Powder should be spread evenly over back, neck, and upper thoracic area. Control for periods of two or three weeks is reported after a single application.

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Milk Replacer Diet for Orphan Pigs

Add to 2 qt. whole cow's milk, 3 oz. cream, 3 oz. corn syrup, one egg, and mix thoroughly, then warm. Give each pig 1 oz. every two hours for the first 24 hours, 2 oz. every three hours for the following three or four days, then trough feed the milk replacer diet.—*T. L. Steenerson, D.V.M.*

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Fungus on the feet of dogs responds favorably to 10% mercurochome.—*R. T. Stapleton, D.V.M.*

Effects of Ionizing Radiation on Animals

In his address at the opening session of the Missouri Veterinary Medical Association meeting in St. Louis on February 21, Lt. Col. Bernard Trum referred to the dangers to livestock of ionizing radiation and the effects of fall-out after atomic detonation.

All animal life would be destroyed within a well defined radius of the blast point depending on the size and activity of the bomb. Fall-out of radioactive materials for large areas beyond this are of chief concern for man and animals. Radioactivity, according to the speaker, is not new in the sense that it has been with us always as cosmic rays from sun or stars or other origin. As the cloud rises from atomic explosion, various sizes of sand, and earth particles are lifted, become radioactive and then fall out over considerable area, the direction being determined by factors of winds aloft. Larger particles fall out first, then smaller ones. Some activity would deteriorate immediately; some other would lose energy only by decay over a variable time.

Persons in the path of fall-out of an atomic cloud can be warned in advance to take shelter, which need not be deep, for protection against beta particles. Hay covered shelter would protect animals. Houses having several layers of protective covering would serve to protect persons. However, too early contact with exposed salts or forage is hazardous. Research is continuing on the problem of radioactive elements and information will be made available as facts develop that will indicate courses of action in the event of such catastrophe.

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Effect of Drugs on Fertility of Turkey Eggs

During the turkey breeding seasons of 1952-1953 and 1953-1954, four different groups of turkey breeders fed four different histomonastatic agents, according to report in *Poultry Science* for September 1954. Agents employed were furazolidone, histostat, enheptin®, and arsanilic acid. In each trial, the authors stated, egg production and hatchability was reduced by arsanilic acid. Other drugs employed in these trials had little or no influence on either egg production, fertility, or hatchability.

®Lederle Laboratories Div., Pearl River, N. Y.

Growth Stimulation Related to Effect on Thyroid Gland

To determine the mechanism of growth stimulation due to additives to poultry feed, Drs. W. J. Mellen and E. F. Waller, Department of Animal & Poultry Industry, University of Delaware, Newark, studied 80, eight-week-old New Hampshire chickens "showing no overt disease symptoms." Divided into eight groups, duplicate groups of the chickens were medicated as follows: (1) None (control), (2) aureomycin, 75 gm./ton of feed, (3) bacitracin, 100 gm./ton, and (4) furazolidone at 100 gm./ton.

Reporting in *Poultry Science* (33:1036 [Sept.], 1954), the investigators describe their results which indicate that the mechanism of growth stimulation may be related to effects on the thyroid, rather than on intestinal microorganisms. After treatment, birds were killed and the thyroids weighed separately. They found that "thyroids in the three treated groups were considerably larger than those in the controls. The treated birds also weighed more than the controls." Those treated with furazolidone (furoxone,® Eaton) produced the heaviest birds.

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Caution Label on Stilbestrol Treated Feeds

The Illinois State Department of Agriculture has announced that it will license mixed feed containing diethylstilbestrol for fattening beef cattle under certain conditions. Each bag of feed must bear a tag on which appears in bold letters the word WARNING. Statement must also be included that the bag contains stilbestrol and that the feed is to be used to fatten beef cattle after they have attained a weight of 600 lb., provided said beef cattle are to be slaughtered. Such drug-treated feed is not to be used in rations for breeding animals, dairy cattle, swine, sheep, poultry, or any growing animals.

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More cattle were slaughtered in California during 1954 than in Illinois, in spite of the fact that Chicago is considered the packing center of the world. Total kill in California for the first ten months of last year is reported as 1,908,000 head. During the same period 1,795,000 were slaughtered in Illinois and 1,561,000 in Iowa.

Cutter-Lockhart Merger

Cutter Laboratories, Berkeley, Calif., has acquired all stock of Ashe Lockhart, Inc., Kansas City, Mo., according to joint announcement from the Cutter Laboratories and Ashe Lockhart, Inc.

The Kansas City firm of Ashe Lockhart, Inc. was founded in 1927 by the veterinarian whose name it has borne since establishment. Products produced and distributed have been limited to selected items prepared by approved technics. The firm has grown to include a modern manufacturing plant and a large serum farm in rural Platte County. Facilities on the farm make possible maintenance of horses and cattle under ideal conditions, hypering technics, and bleeding.

In the announcement referred to above, spokesmen for both firms have emphasized that no change is anticipated in basic operation policies of either company. Dr. Joe Knappenberger will head the company as its new president. Dr. Glen L. Dunlap will continue in his capacity of laboratory director, and Dr. Busch Meredith as assistant.

The Board of Directors of Ashe Lockhart, Inc. have been selected. They are: Ashe Lockhart, Clifford Haver, Joseph Knappenberger, Guy A. Railsback, Norwood Casselberry, Harry R. Lange, and Robert K. Cutter. Doctor Railsback, Veterinary Products Manager, Cutter Laboratories, will serve also as vice-president in charge of sales.

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Wisconsin workers are first to report experimentally-produced salt poisoning in pigs. From this it is evident that symptoms and death from salt poisoning results only under extremely poor management practices.

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The California State Veterinary Medical Association's midwinter conference, January 24-26, broke all attendance records. Official registration was 415.

Dr. W. J. Zontine, Lancaster, is president and Charles S. Travers, San Francisco, is executive secretary.

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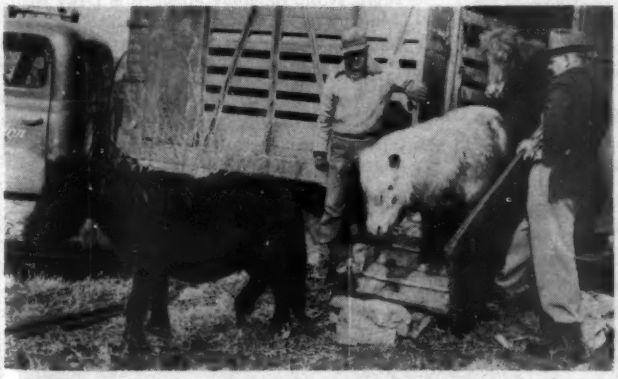
Ponies from the Shetland Islands

Two Kansas City men, Dr. I. J. Twiehaus, general practitioner, and Mr. Jack Ramsey, received the first shipment of 44 head of imported Shetland ponies on February 23, 1955. These constitute foundation stock for a proposed breeding operation to be rather extensive.

Ponies were purchased in the south of England, the Shetland Islands, Scotland, and Wales, and were concentrated for shipment in Liverpool, England. It was noted that primary items of diet in the homeland of these animals were whole turnips and wild grass.

Doctor Twiehaus advised that antibacterial serum (equine), mixed bacterin (equine) formula 1, and penicillin were shipped to England with instructions for their use prior to shipment. British veterinarians employed refused to administer the serum but gave one dose of bacterin to each animal three days before loading for the water trip. Because of exposure and other factors all animals arrived in rather poor condition, some showing respiratory distress, coughing and other symptoms of equine strangles. All are improving at the excellent facilities available for their care at their new home.

All specimens are of excellent type, averaging 32 to 38 in. in height and 350 lb. in weight. Hair colors range from light grays to blacks. Coats are shaggy, thick and dense.



Shetland ponies being unloaded at the Dr. I. J. Twiehaus farm south of Kansas City. Doctor Twiehaus (at right) assisting driver of the transport carrier with the animals after a 45-hour trip from New Jersey.

Drovers Telegram photo.

Doctor Ferguson Cited for Distinquished Service

Six Wisconsin men and women were selected for recognition recently for outstanding service to rural life in that state. Among these was Dr. Thomas H. Ferguson, practitioner,

Dr. Thomas E. Ferguson as he appeared on February 2, 1955 on the occasion of Farm and Home Week, Wisconsin University, College of Agriculture, Madison.

Lake Geneva, cited as "A valued counselor to farm people and a leader in maintaining high standards for his profession."

Doctor Ferguson, ONT '96, established himself for practice in his home town immediately after his graduation and has continued to serve his community since — an active practice tenure of nearly 60 years. At 81 years of age, Doctor Ferguson enjoys practice, stating that he has considered retirement but prefers to remain active.

Doctor Ferguson has lectured in most of the major veterinary colleges in the United States and Canada. In 1938, he was chosen one of nine men to receive the golden key of the American Veterinary Medical Association for outstanding service to the profession. In 1945, *Look* featured him in a "pictorial day in the life of an animal doctor", and in 1946 he received the XII International Veterinary Congress prize in recognition of distinquished services to veterinary science. He is a member of the Wisconsin State Board of Veterinary Examiners, past president of the Wisconsin Veterinary Medical Association, past president of the A.V.M.A. (1929-1930), and member of the National Livestock Sanitary Board. He is a member of the Committee on Veterinary Services for Farm Animals and the Committee on Training Veterinarians, both with the National Research Council.

His son, Dr. Stanley E. Ferguson COR '27, is associated in the Lake Geneva practice.

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Telegram Hoax Victimizes Veterinarians

The *Los Angeles Times* for February 19, 1955 carries a story of a hoax having little basis for design yet setting off a reaction of state officials and private veterinarians in the Los Angeles area.

The Los Angeles County Livestock Department received a call from a person representing herself as secretary to Dr. Arthur G. Boyd, State Department of Agriculture, Sacramento. The report stated that the County Department should advise all veterinarians in the area by telegram to "stock up on citrus juice, raisins, and oxygen". Telegrams were dispatched and charged to the State Department before the hoax was bared on check with Doctor Boyd.

The genuineness of the original message was not questioned immediately, it was explained, because Doctor Boyd is coordinator for veterinary medicine with the State Office of Civil Defense, in addition to his duties as State Veterinarian.

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Nymphomania in Cattle

(Continued from page 174)

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PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Dangers of Overdosing

We heard a practitioner report about being called to determine the cause of death of several birds in a flock. Examination of birds and questioning disclosed that the owner had been treating the flock for coccidiosis with a sulfaquinoxaline preparation. Directions on the package containing the drug indicated that a specified amount was to be added to drinking water. The birds were on dry feed so that they consumed more than the usual amount of the medicated water. Each time the container was dry more medicated water was made available and several of these replenishments finally resulted in overdosing and death.

We recall a somewhat comparable situation that occurred a few years ago when a diagnosis of so-called "sweet clover poisoning" was made in a herd of cattle. We advised the owner to discontinue feeding of sweet clover, and considered the matter settled. Much to our surprise a few weeks later the owner again sought our services as he said several more of his cattle had developed noninflammatory, fluctuating swellings. Our second trip to this farm revealed that the owner was no longer placing the sweet clover in the feed rack for his cattle, but, being an economically inclined individual, he was using it for cattle bedding and the cattle being only of average intelligence consumed the bedding as eagerly as they formerly were taking it from the feed rack.

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Botulism in Turkeys

There appears to be more frequent diagnosis of botulism in turkeys, during recent years, than in other species of barnyard fowl. Poultry pathologists explain this, in part at least, by the fact that night after night turkeys roost in the open in the same place so that shortly a thick layer of droppings accumulate under each roost. As a sequence, anaerobic botulinus organisms develop profusely so that turkeys, in their search for food, scratch in these accumulations to pick out particles of food, and incidentally the organisms. Infected turkeys frequently crawl into piles of rubbish or brush to die and are later discovered by the flock owner, and thus serve as an additional center of infection for the remainder of the flock. The handling of this situation consists of frequently breaking up the accumulations of droppings under the roosts, and of course, in the face of an outbreak, the use of botulinus antitoxin on the disease-free members of the flock.

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Minimum Temperature Exposure to Destroy Trichina

Veterinarians frequently are asked for information about the required low degree of temperature to destroy Trichina larvae that may be present in pork and pork products. In general, textbooks on meat inspection and on parasitology indicate temperatures that must be reached in the deepest portion of the pork, and the minimum time of exposure as follows: 16.6 F. for 36 hours; 22 F. for 24 hours; 27.4 F. for 10 hours; 31 F. for 40 minutes; 34.6 F. for two minutes. On the other side of the scale, that is by heating or cooking, the deepest portion of the pork should be heated to at least 150 F.

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Blood Infusion for Weak Calves

When calves are weak at birth, they frequently may be stimulated by administering about 150 to 200 cc. of the dam's blood subcutaneously. Blood is obtained by using a local anesthetic over the jugular vein, inserting a 12 gauge needle and a 40 cc. syringe to abstract the blood and immediately transfer it to the calf. As supportive treatment for more specific medicinal handling of the patient such practical blood infusing technic gives encouraging results.

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A symptom, colloquially spoken of as "bicycle riding", is said to be quite common clinical evidence in the later stages of enterotoxemia (gut edema) in pigs, especially at the time that the animals are four to six weeks of age.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Bacteria-free Cultures of Hexamita meleagridis

Hexamita meleagridis, the protozoan responsible for the turkey disease hexamitiasis, has been propagated successfully in bacteria-free culture for the first time by Hughes and Zander (*Poultry Sci.*, 33:810, 1954). To accomplish this, they placed 10 mg. of streptomycin and 10 units of bacitracin into the allantoic cavity of eight- to 12-day-old chicken embryos simultaneously with Hexamita-infected intestinal contents. Maximum growth occurred on the 15th day of incubation in embryos inoculated on the 8th, 9th, and 12th days.

No apparent abnormalities were observed in embryos inoculated with a bacteria-free culture of Hexamita in chicks which were allowed to hatch. Hexamita persisted in chicks for as long as ten days after hatching. This is considerably less than the 22 days found by McNeil and Hinshaw (*Cornell Vet.*, 31:345, 1941) when chicks under one week of age were given infected gut contents orally or rectally. It is not surprising that Hughes and Zander did not observe abnormalities in either chick embryos or in chicks that hatched from infested embryos, since it has not been possible to produce the disease in chickens.

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Discoloration of Egg Yolk

The presence of certain substances in cottonseed which cause discolorations in egg yolk and albumin limits the desirability of including cottonseed meal in diets for laying hens. Heywang, Bird, and Thurber (*Poultry Sci.*, 33:763, 1954) have found that the component responsible for pink albumin is present in raw cottonseed and in cottonseed pigment glands but not in the hulls. It was present in cottonseed meal extracted with hexane but not in that extracted with methyl-ethyl ketone or isobutane.

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Slogan for the poultryman and livestockman: "Twice a day see if your animals look well; twice a month have your veterinarian see that they remain so."—*C. A. Brandly, D.V.M.*

Incidence of Salmonellosis in Poults

Lukas and Bradford (*Jour. Am. Vet. Med. Assn.*, 125:219, 1954) found that *Salmonella typhimurium* led all other species as the cause of salmonellosis submitted to the Turlock Diagnostic Laboratory of the California State Department of Agriculture in 1952. Of 1,148 poults, one to nine weeks of age, submitted for diagnosis, 241 (21%) yielded Salmonella species. A total of 30 types were isolated one or more times. *S. typhimurium* accounted for 79 (32.7%) of the cases, and the leading six included *S. anatum*, 33 cases (13.7%); *S. give*, 14 cases (5.8%); *S. manhattan*, 12 cases (5%); and *S. newport* and *S. cubana*, each 10 cases (4.2%). The cases reported were all from the northern San Joaquin Valley in California.

In addition to leading all other species in total incidence, *S. typhimurium* accounted for an even higher percentage of the uncomplicated cases (46.5%) of salmonellosis diagnosed in 1952. In a similar survey conducted in California by the writer and coworkers in 1935 to 1943, *S. typhimurium* also led in a group of 47 different types found in 291 outbreaks of turkey. In these outbreaks, (*Am. Jour. Hygiene*, 40:264,1944) *S. typhimurium* accounted for 60% of the cases in turkeys and 35% of the cases in chickens. In chickens, *S. bareilly* led as it caused 42% of the outbreaks. It is generally recognized that *S. typhimurium* is not only the most ubiquitous in its distribution among all animal species, but it is the type most often found to be associated with outbreaks of human food poisoning.

In their studies on the outbreaks, Lukas and Bradford made a survey of remedies used by growers. Terramycin[®1] and chlortetracycline (aureomycin[®2]) were the drugs of choice for reducing mortality.

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Breeds of Chickens for Meat and Egg Production, USDA Farmer's Bulletin 2065, contains detailed information, with excellent illustrations, on the breeds and varieties used for production of food. Farmer's Bulletin 1391 is good reference on Guinea Fowl.

[®1]Chas. Pfizer & Co., Brooklyn, N. Y.
[®2]Lederle Laboratories Division, Pearl River, N. Y.

VETERINARY PARASITOLOGY

A. O. FOSTER, B.A., M.A., Sc.D.
Beltsville, Maryland

Larvae of Swine Ascaris Cause Lesions in Cattle

Studies at the New York State Veterinary College have shown that the migrating larvae of *Ascaris lumbricoides*, the common large roundworm of swine, are capable of producing focal eosinophilic hepatitis and pneumonia in cattle[1]. The lesions, moreover, have an immunological basis, since they occurred mainly, or entirely, in animals that had been sensitized by a primary migration of larvae. Lesions associated with initial infections were essentially traumatic, such as hemorrhages and necrosis. The author writes that, "The gross and microscopic features of the lesions produced experimentally in sensitized cattle are similar, in all respects, to the naturally-occurring disease in cattle and those described in Löffler's syndrome in man".

The report is a superior contribution from standpoints of both observation and experiment, and throws significant light on the probable etiology of eosinophilic granulomas of cattle as well as on the somewhat analogous syndrome in man. It deals, moreover, with two basic problems of parasitism on which there is comparatively limited information, namely, the injuriousness of parasites in animals that are essentially abnormal hosts for the species, and the significance of the larval phase of helminthiases. Also, the paper contains an especially informative, documented discussion on the pathology occasioned by migrating Ascaris larvae.

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A case of opthalmomyiasis in a 14-year-old Maryland boy, with the sheep nosebot (*Oestrus ovis*) the offending agent, has been described from the U. S. Naval Hospital at Annapolis[2]. The report notes that similar cases had been recorded previously in the United States, one in Texas and another in Arizona.

[1]Kennedy, P. C., The Migrations of the Larvae of *Ascaris Lumbricoides* in Cattle and Their Relation to Eosinophilic Granulomas. *Cornell Vet.*, 44:531, 1954.

[2]Menk, K. F., *et al.*, Ophthalmomyiasis. *U. S. Armed Forces Med. Jour.*, 5:732, 1954.

Effect of Stilbestrol on Secondary Sex Glands of Treated Lambs

Groups of lambs were treated by stilbestrol (15 mg.) pellet implantation at the beginning of the feeding period. Approximately 50% of the treated lambs received a second 15 mg. pellet after they had been on fee for 70 days.

Significant differences in weight gains and efficiency of feed utilization were demonstrated and confirmed findings of other investigators. Of especial interest in these trials was the loss of 12 lambs of 517 from prolapse of the rectum and from excessive swelling and inflammation in the perineal region[4]. Virtually all treated lambs, both those receiving one pellet and those receiving two, had preputial swelling and exhibited distress during urination. Measurement taken of the urogenital system of treated and control animals revealed enlarged seminal vesicles, bladder, ampullae, urethra, prostate gland, and bulbo-urethral glands of the treated lambs.

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California workers recently have diagnosed filarial dermatosis, caused by *Elaeophora schneideri*, in native sheep of California and in sheep brought into that state from Oregon[5]. The disease heretofore was known or presumed to occur in Arizona, New Mexico, Colorado, and Utah. Although the adult parasite appears to have been recovered from affected sheep only in New Mexico and California, investigators elsewhere have observed either clinical cases among sheep or parasites recovered from deer. The latter host does not suffer from dermatosis, so far as known, but in some areas the incidence of infection in this reservoir may be comparatively high. The California workers noted that fuadin® (stibophen) and anthiomaline are reported remedies for use in sheep but neglected to mention the combination of tartar emetic and glucose which is as reliable and far more economical.

[4]Bell, T. D., Smith, W. H., Erhart, A. B., The Effect of Stilbestrol upon Lamb Performance in the Feedlot. *Jour. Ani. Sci.*, 13:425 (May), 1954.

[5]Douglas, J. R., *et al.*, *Elaeophora schneideri* Wehr and Dikmans 1935 (Nematoda, Filarioidea) in California Sheep. *Cornell Vet.*, 44:252, 1954.

®Winthrop-Stearns, Inc., New York, N. Y.

ITEMS OF VETERINARY INTEREST

Water and salts are most commonly neglected of all dietary items for farm livestock.

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The practice of selecting breeding gilts from fattening lots is not considered to be economically sound.

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Insufficient supply of carbohydrates and a trigger factor, as any stress item is likely to be, may result in ketosis.

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The time has passed when a veterinary practitioner can cope with disease problems without benefit of an adequate diagnostic laboratory.

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Under pasture management conditions in Michigan, sheep are treated once or twice during the summer months with phenothiazine and lead arsenate to remove accumulated overload of parasites. This is in addition to continuous administration of phenothiazine with salt.—*Frank Thorp, Jr., D.V.M.*

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The successful culture of *Hexamita meleagridis* free of bacteria is a significant accomplishment which will give investigators an opportunity to do important fundamental pure-culture studies with this parasite. It is hoped that some one soon will infect turkey embryos with pure cultures to determine the effects on them by serial passages and in poults allowed to hatch from infected embryos.

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Dr. Samuel Elmer Honored

Dr. Samuel Elmer, OSU '34, Richland Center, Wis. was named "Wisconsin Veterinarian of the Year" by the Wisconsin Veterinary Medical Association. The award, first of a series tentatively scheduled, will recognize meritorious service of veterinarians to their profession and community.

Doctor Elmer was cited for his part in making large animal surgery practical, his energy and devotion to organized veterinary medicine in the state, and his work with boys. He has managed the Richland Center Rockets baseball team for 15 years.

Incidence of clinical parasitism in cattle appears to be increasing in some portions of the country.

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Reports from California indicate an unusually high incidence of abortion in ewes vaccinated with bluetongue while pregnant.

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Veterinarians do not have exclusive rights for selling medicinal agents. The Congress of the United States has set the policy of the owners right to treat his own livestock. One must expect competition and reasonable margins on dispensing. Owners may be made to realize that a service is rendered when a product is dispensed to a well informed client after questioning, by a practitioner. Agents employed for treatment of livestock diseases can not be expected to effect resolution unless used properly.

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Veterinarians in Civil Defense

The Federal Civil Defense Administration told America's veterinarians today that they should prepare themselves now to lend their skills to the treatment of human casualties in the event of a national emergency.

The urgent need for their assistance to the medical profession following an attack is outlined in a newly-published FCDA technical manual entitled, The Veterinarian in Civil Defense (TM-11-11). The booklet is being distributed to Civil Defense officials and national veterinarian organizations. Copies are on sale at 15 cents each by the Superintendent of Documents, Washington 25, D. C.

The three principal roles of veterinary medical services in a civil defense emergency are listed in this order:

1. Assistance to the medical profession in the treatment of casualties immediately following an attack, when the numbers of casualties may be far greater than the available supply of physicians can handle.

2. Protection of food animals against diseases and the effects of atomic, biological, and chemical warfare.

3. Food inspection services for meat, poultry, and other foods of animal origin.